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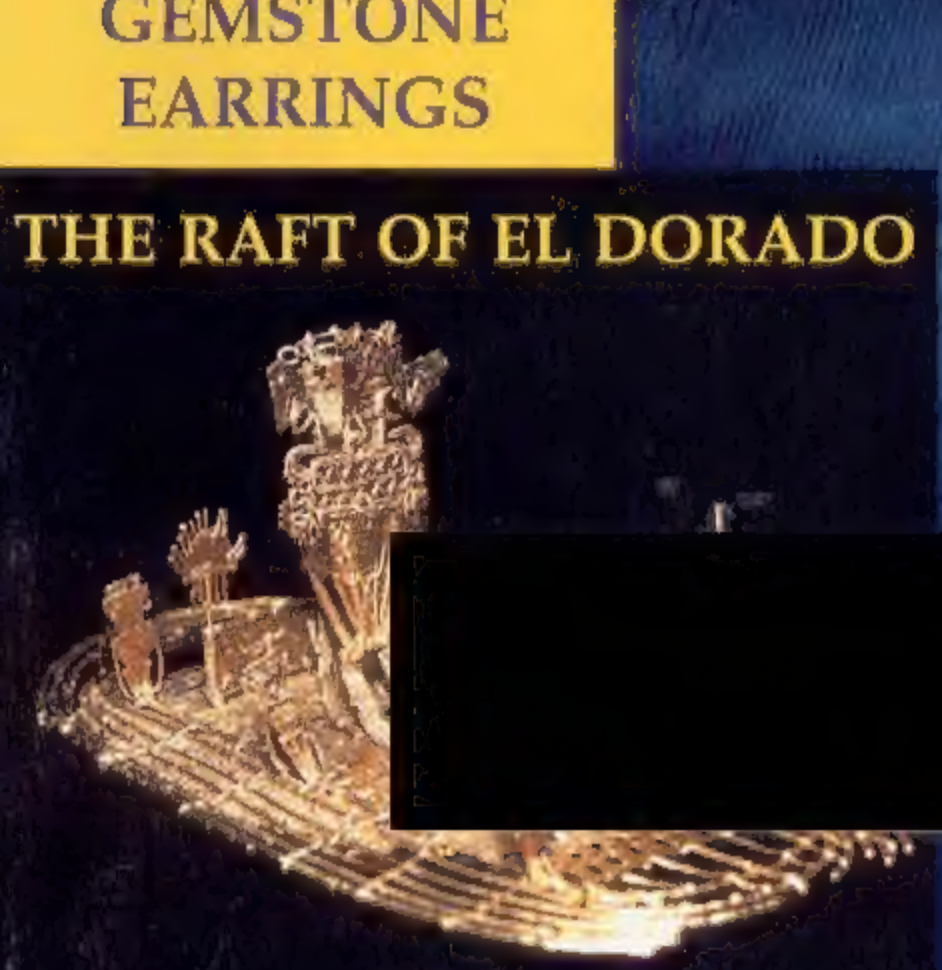

JULY 2002

Rock&Gem

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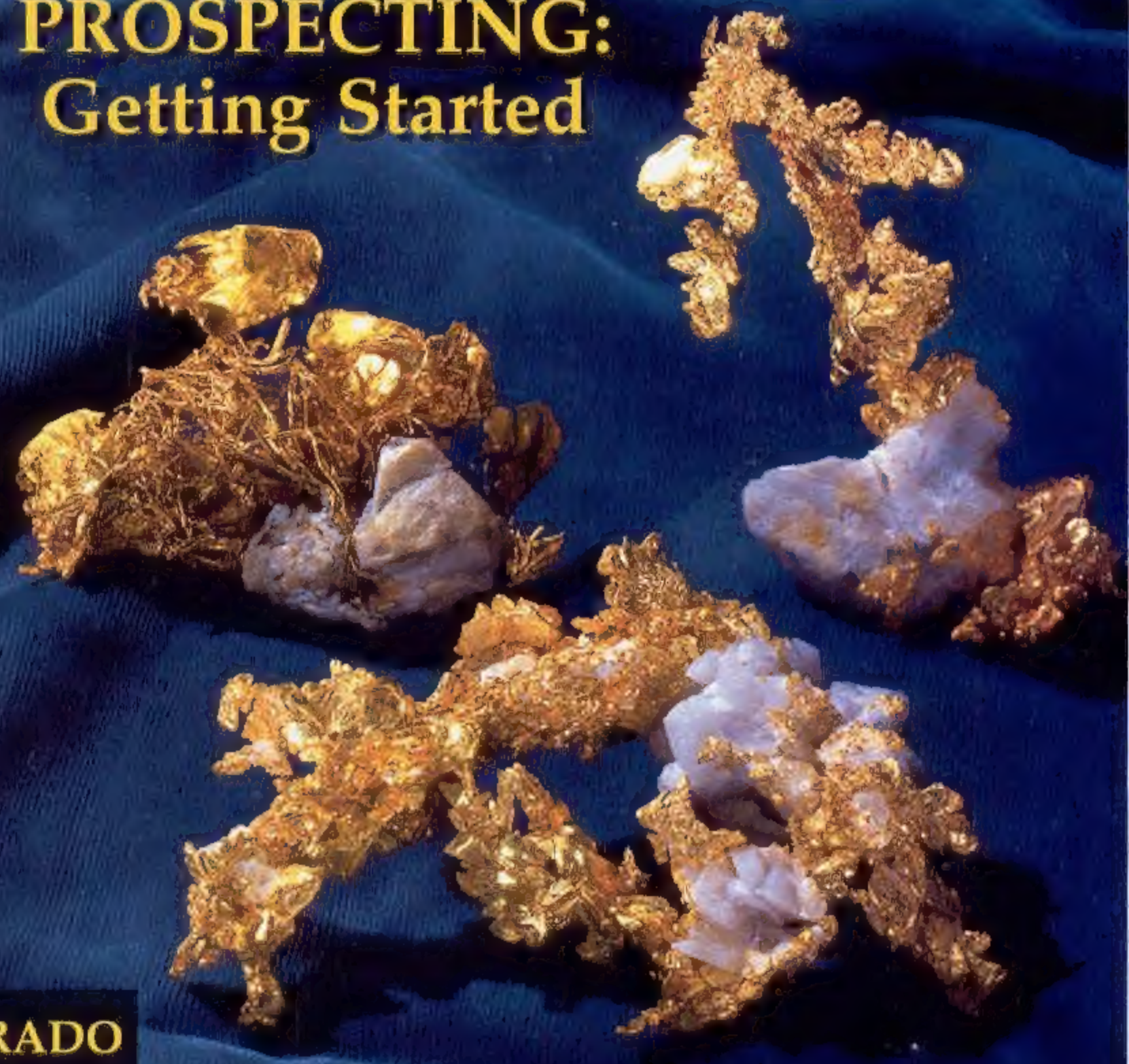
GOLD

PROSPECTING: Getting Started



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COVER: California gold in the collection of Wayne and Donna Leicht (Kristalle), Laguna Beach, California. (Photo by Earl Lewis)

Rock&Gem

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SHOP TALK

by William A. Kappele

Unique Lapidary Machinery

The photo accompanying this month's column was sent to me by Fred Stone of South Haven, Michigan. It shows a tumbler that he picked up at a sale. It is obviously unique, and Fred wanted to know if I had ever seen one like it. I hadn't, but I thought that someone out there must have.

According to Fred, the tumbler was made in New York around 1942. They were obviously built to last back then. Just take a look at the beefy castings and the big oil cups on the bushings. Seeing this picture got me to thinking about all of the other strange lapidary machines—both factory made and homemade—that must be kicking around out there in "reader land." It would be really interesting to see a bunch of photos of these things in the magazine. How about getting out the Brownie and sending in some pictures?

Fred Stone's unique tumbler.

One such item I'm thinking of is the mud saw. Although this device might be unique today, once upon a time, the mud saw not only was not unique, it was the only game in town and on the cutting edge (no pun intended) of the day's technology. For those of you too young to remember, a mud saw was not used to saw mud, nor was it made of mud. It was simply a device that dragged a slurry of silicon carbide or other suitable grit across a rock and into the kerf. The method worked and still works today. Mud saws can and do cut huge boulders and petrified tree trunks into manageable slabs. One thing they are not, however, is fast. In fact, if you should choose to time a cut, you should use a calendar and not a stopwatch.

The mud saw's trip to the lapidary museum began just before World War II, when the diamond saw blade was developed. Once this blade became available to the lapidary hobbyist, homemade saws sprang up everywhere. To call some of them unique is an understatement. They were made from everything from old lumber scraps and nuts and bolts to converted woodcutting saws. The washing machine motor was a favorite power source. Washing machines wore out, but the motors never seemed to.

Of course, with the blade doing its job, attention was turned to the vise and the feed mechanism. With the mud saw, no vise was needed, since the boulder wasn't going anywhere. With the smaller diamond saws, something had to hold the rock to keep it from twisting. Various combinations of holding devices were tried with varying degrees of success.

Once a satisfactory vise was settled on, some means of pushing the rock through the blade had to be devised, and this is where some really unique gadgets popped up. One of the earliest methods, which is still used today on some commercial saws, was the gravity feed. A cable was attached to the vise, run over a pulley, and fastened to a container of water, sand or whatever was handy. The weight of the water or sand pulled the vise and the rock into and through the blade.

Still another weight device used a cord wrapped around a long bolt. The weight pulled the cord, which turned the bolt and pushed the vise forward.

Maybe the most unique of all was one I saw in an old book. The vise was mounted to an arm that pivoted. The weight of the rock carried the rock and the vise downward into the blade.

This barely covers a tiny number of the unique, old lapidary machines. I'll bet there are still a lot of them out there, so look around and send in some pictures. Let's share a little history of our hobby.

Please feel free to contact me if you have a suggestion or comment about this or any of my Shop Talk columns. My e-mail is quappelle@cox.net, or write to me at 25231 Pericia Dr., Mission Viejo, CA 92691.

GOLD PRO

Ed Butler pours gravel into a sluice while the author scans for nuggets. Below, a large dredge is being prepared to recover mid-river paystreaks. (Photos courtesy the author)

Whether as flakes or nuggets, gold is beautiful and profitable.

PROSPECTING: Getting Started

Choose a Method That's Right for You

by Gail Butler

The best way to get started enjoying the adventure, the fun, and the profit (yes, profit!) of recreational gold prospecting is to select a technique that appeals to you! To help you discover which that might be, I've briefly described each technique, its approximate expenditure in exertion and listed what equipment you'll need.

The simplest and least expensive techniques are generally also the least physically demanding.

To learn specifically how much money you will have to spend to outfit for each item of equipment, see my article, "The Gold Prospector's Equipment Guide" in the January 2002 issue of *Rock & Gem*.

Basic Gold Panning

Gold panning is the most basic technique of gold prospecting and can cost as little as $5.00 to get into. All other methods build upon and expand from this foundation.

Gold panning requires little in physical exertion. This technique can be enjoyed by the physically challenged. Many good gold panning areas are easy to access with wheelchairs, crutches and walkers.

To pan for gold you will need:

1. A gold pan
2. Shovel and/or garden trowel
3. Rock pick
4. Tweezers
5. Vial

This is about as basic as it gets! If you wish, you can add a loupe or small magnifying glass for aid in spotting fine gold.

A trowel is needed for digging gold-bearing gravel from rocky nooks and crannies too tight for a conventional garden shovel.

continued on next page

The author shovels dirt into a drywasher. Note that she is wearing a bandana so she won't inhale dust from the operation.

Gold Prospecting: Getting Started *from page 21*

You may want to add a "snuffer" bottle to suck flake gold out of your pan instead of picking it out with tweezers. A pair of gardening or work gloves will protect your hands from abrasion on rocks you'll be working near.

Along with this panning outfit I usually toss in a coffee can with a plastic lid (another "no cost" item).

It is time consuming to sit and pick out all the flakes of gold in each pan full. I usually remove the larger pieces of gold and nuggets and drop them in my vial to admire right away. Black sand remaining in the pan and the fine gold it contains is poured into the coffee can to save for leisurely panning at home.

There are a variety of ways to remove fine gold from your pan. One way is to sit patiently and pick out all the fines with a thin, tapered artist's brush, swishing them off the brush into a water-filled vial.

The best and least expensive method is to use a Gold Miser sluice to recover the fines. Slowly pour water containing black sand over the Gold Miser sluice. Then simply wash the fines from the Gold Miser sluice into a container. Use a small funnel to pour the gold and water into a vial.

Of course, the use of mercury is one way to separate fine gold from black sand, but this requires purchasing a retort ($80 to $100).

For this reason, I recommend the Gold Miser sluice at only $11.00. You still recover your fines, save a lot of money and don't need to stockpile mercury.

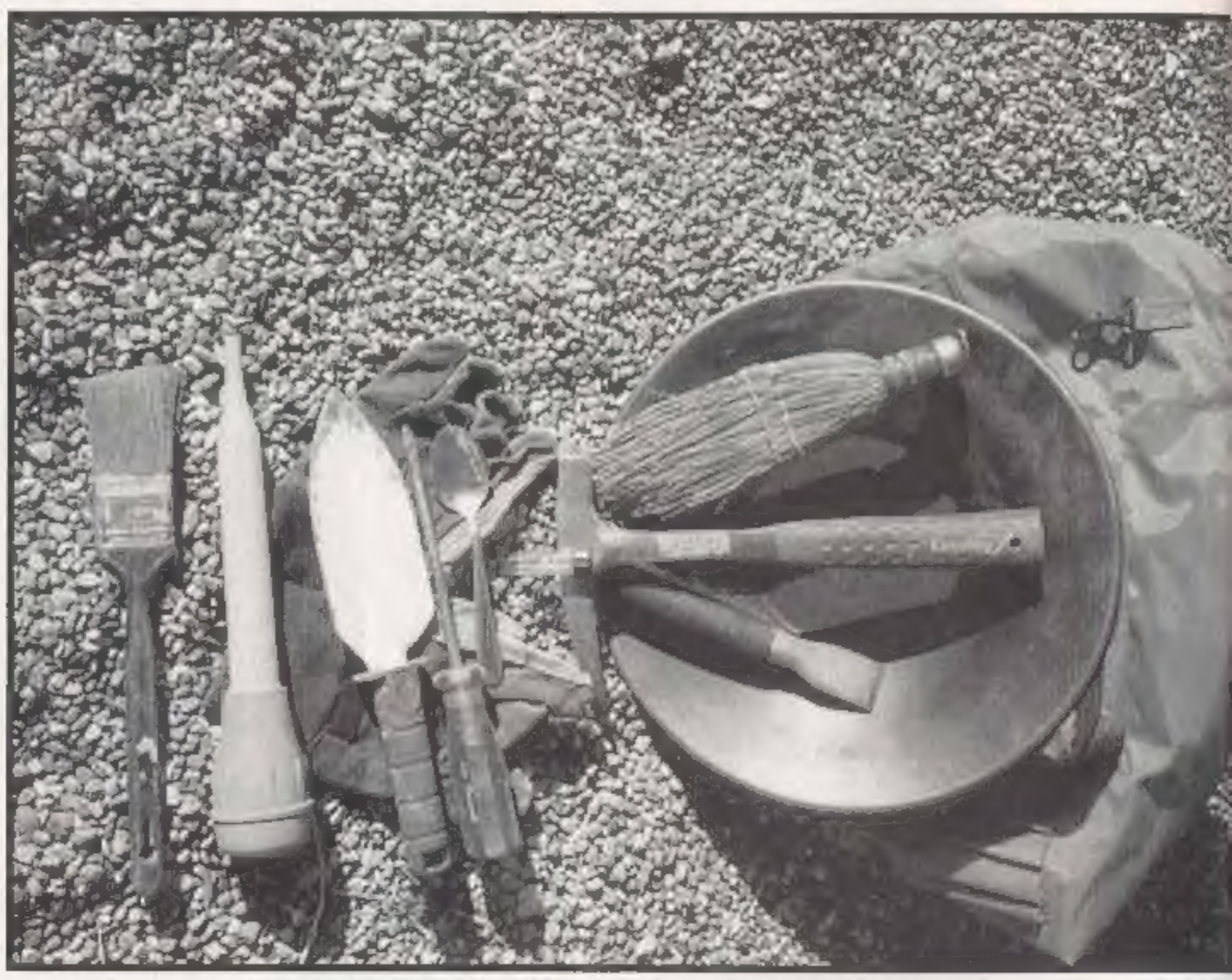
Order the Gold Miser sluice from Sluice Box Inc., 16745 N. Oak Hill Lane, Mount Vernon, IL 62864, phone (618) 244-0505, FAX (618) 244-9191, or e-mail Doc Asheraft at doc@sluicebox.com.

Chances are you already own a trowel, a shovel and a pair of gardening gloves to add to your panning outfit. Most households are equipped with a pair of tweezers and most rockhounds and mineral collectors already own a rock pick or chipping hammer.

This basic gold panning setup allows you to sample pan for concentrations of gold and to recover them by panning.

With a pan, you can also recover gold-bearing gravel from bench deposits. Bench deposits are located above the present day flow of creeks and rivers and are composed of semi-cemented, or compacted, dirt and rock.

For safety's sake, when digging into these old deposits, don't undercut large boulders and be careful that digging doesn't create an avalanche of material onto yourself or anyone below.



Shown is a collection of easy-to-find crevicing equipment.

Easiest of all is to dig and pan the gravel lying alongside or near a gold-bearing creek or river. Gold-bearing gravel is most often located on the downstream sides of boulders, around the roots of trees and grasses, or along sand and gravel bars adjacent to a creek or river.

For more information on where gold is found along a watercourse and on how to operate a gold pan send a self-addressed, stamped envelope to me at Gold Fever Gail's Gold Panning Secrets, P.O. Box 212, Elsinore, Utah 84724, and I will send you my free brochure.

Crevicing for Gold

This technique is one of my seasonal favorites I employ just after water levels in rivers and creeks begin to drop in early spring as runoff from winter snowmelt begins to abate. Using this method I can recover flakes and nuggets from bedrock crevices freshly revealed by shrinking water levels. The chance of recovering large flakes and nuggets is often higher with this technique than with basic panning.

The physical expenditure of this method is even less than with panning. It will take time to clean out each crevice, requiring you to sit in one spot for a longer period.

The contents of bedrock crevices have been concentrated by river action, thus there will be no fine dirt, sand or organic material to take up space in your gold pan or cloud your panning water. The contents of crevices are generally minimal and will greatly reduce the amount of weight in the pan during the initial stages of panning.

This method employs your basic panning outfit with the addition of some easy to find "freebies" such as:

1. Screw drivers
2. An old paintbrush and/or whisk broom
3. One or two old metal spoons (a large one and a small one) that you've bent the bowl sides in toward the middle to form a narrow trough.
4. A chisel, crack hammer, and safety glasses are optional for opening or widening narrow crevices for easier access.
5. Paper picnic plates

With this outfit you dig, scrape, and sweep out sand, gravel, clay and gold from the crevice with your screwdrivers, spoons and trowel onto a folded paper plate ... whatever it takes to remove the contents of the crevice. Deposit all your gleanings into your gold pan for subsequent panning.

Rub and rinse any gobs of clay you extract between your fingers into your gold pan for panning. Clay often contains a high percentage of gold that will be lost in panning if you don't break it up.

Your snuffer bottle can be used to direct a jet of water into tiny cracks to dislodge particles of gold and suck them up.

Sniping for Gold

Adding the technique of sniping to

your basic gold panning outfit incurs little extra cost. Sniping entails recovering gold from bedrock cracks just below the surface of the water. For this you'll need your basic crevicing outfit and:

1. A prospector's glass for locating those underwater cracks and crevices.
2. A bulb snifter

I suppose you could use a diver's facemask, put on your bathing suit and go for total immersion. A snorkel would allow you to spend more time underwater without the need to surface for a breath of air and in the summertime this is a great way to get a little gold and stay cool at the same time.

However, in early spring when the air is cool and the water is downright cold, using a facemask would require that you get your face and head wet with each peek beneath the water, and total immersion is out of the question! Hence, the need for a prospector's glass.

It's easy to make a prospector's glass and costs next to nothing for the materials. The only cost you might incur is for a sheet of plastic or styrene for the viewing lens.

Basically, a prospector's glass consists of a tube with a viewing lens in the bottom and an attached handle for gripping.

To make one you'll need a large juice can, 1½- to two-liters, at least. Remove both ends with a can opener. Spray the can inside and out with some leftover spray paint so you won't catch the glare of shiny metal during use.

Trace the outside diameter of one end of the can onto a firm sheet of styrene or clear plastic. I use a jeweler's saw to cut the plastic initially to shape and a lapidary grinder to smooth the rough edges into a round. Smooth and perfect the shape until you can slip the lens down inside the can and shove it into the bottom.

Use waterproof sealer to secure the styrene lens into the bottom of the can. I draw a bead of glue around both sides of the lens to insure there will be no leaks. Drill a couple holes into the side of the can and bolt on a metal garage door handle. Use your sealer around the bolt holes to insure there will be no leaks.

After 24 hours' drying time, I immerse the prospector's glass deep enough into a tub of water to test the seal around the lens and around the handle. Apply more sealer if needed.

With this handy tool, you can peer beneath the water, looking for cracks and crevices that may contain nuggets and flakes of gold while keeping your face dry.

Insulated, waterproof gloves further add to your comfort when you need to open these underwater crevices to check for gold.

Use your screwdrivers and spoons to carefully scrape and lift out gold-bearing gravel from narrow crevices for subsequent panning. Because this operation takes place underwater care is needed to retain the crevice material from drifting away. To forestall this, I often use a bulb snifter (for adding water to a car battery or basting a turkey) to suck the contents from the crevice for depositing into the gold pan.

Sniping for gold is a little more strenuous than either panning or crevicing because you will be leaning out over the water in order to access and clean out underwater crevices.

Sluicing for Gold

Sluicing for gold is the next step up from basic gold panning, crevicing, and sniping. This method requires a good level of physical fitness because of the all day digging and toting of dirt-filled buckets that is required to feed the sluice.

I like to think of the work of prospecting as an opportunity, not only to get gold, but to get some great exercise as well!

The addition of a sluice box to your basic panning ensemble enables you to process more gold-bearing gravel with greater efficiency than panning—all in a much shorter time.

Set up your sluice in rapidly moving, shallow water as near the location as possible to the spot where sample panning indicated the presence of gold.

You'll need to have a good current several inches deep running through the sluice in order for it to separate and wash away dirt and rocks from heavier elements such as gold and black sand, which will remain behind.

Next, place either a plastic or homemade "classifying" screen on a five-gallon plastic bucket. Manufactured plastic classifying screens fit perfectly atop five-gallon plastic buckets and cost $10.00 to $15.00. If you make your own screen, make a square frame and install ¼- to ½-inch metal mesh.

Shovel gravel onto the screen. Most of the gravel will fall through, leaving rocks larger than the mesh openings sitting on top. Give your screen a shake so that any remaining smaller material falls into the bucket. Check the top of the screen for nuggets larger than ¼- or ½-inch and discard the rocks from the screen.

Tote the filled, or semi-filled, buckets to where you've set up your sluice and slowly pour the gravel into the sluice. As the sluice assimilates the gravel, pour in more.

continued on next page

Gold Prospecting: Getting Started *from page 23*

After several buckets of gravel have gone through the sluice you'll notice the spaces between the metal riffles filling up. Before they fill completely, take up the sluice and rinse the concentrates into a five-gallon bucket for subsequent panning.

Because a sluice is capable of processing considerably more gravel than a gold pan, you will realize greater amounts of gold for your day's work.

While panning your sluice concentrates, you will observe that the water remains clearer and not as cloudy as when dug and panned directly from riverside gravel.

Water passing through the sluice bed and over its interior riffles and matting serves to classify, or separate out, the gold and black sand from fine soil particles, carrying these and the lighter organic elements away downstream.

To sluice for gold you will need in addition to your basic panning set up:
1. A sluice box, three feet long by 10-inches wide is standard and easy to tote.
2. One or two five-gallon plastic buckets you can find for free, or cost around $5 at the hardware store.
3. A classifying screen.

Dredging and Highbanking for Gold

With these two techniques you spend a lot more money and enjoy plenty of "exercise"! It is best to find out whether or not you really like gold prospecting before getting into these two methods. The monetary and physical expenditures are high.

A dredge consists basically of a sluice that floats on pontoons and is equipped with a motorized suction pump and hose to vacuum gold-bearing sediments from cracks and crevices in the bedrock located along river bottoms.

At its most basic, easiest to transport and least expensive is the backpack dredge. Used to recover sediments from shallow creeks and streams, it is small enough to be toted, handled and operated by one person. A pair of waders is usually enough to keep the operator dry.

Large dredges are generally operated by two or more people and are more difficult to transport due to bulk and weight. Large dredges often require trailers to transport them and cost in the thousands of dollars.

One prospector dives beneath the surface to vacuum up river bottom sediments while the other monitors the pump's outflow over the sluice bed looking for evidence of rock jams. This observer also monitors pump and engine operation while at the same time looking out for any indication that the diver might be in trouble or danger.

Permits are required to operate motorized dredging and highbanking equipment, and generally underwater diving expertise is necessary.

While dredging is an expensive technique calling for skill and physical stamina, it is well worth the investment if you are an avid prospector who plans to spend most vacations and weekends in a determined quest for gold. Dredging is also for those who want to find large quantities of gold, are willing to persevere to do so, and don't mind being wet much of the time.

Highbanking consists of a sluice bed on legs to which a pump and engine are attached.

A hose extends down to the river to bring water up to the highbanker. Use a highbanker to recover gold from the upper levels of bench deposits. It can be operated creekside as well.

While a highbanker is far more expensive than a simple sluice, it still necessitates a great deal of digging and shoveling. It does eliminate the need to carry dirt-filled buckets because the highbanker can be set up right where you're digging. You merely drop shovels full of gold-bearing gravel onto the grizzly, or metal screen, over the highbanker's hopper.

As with dredging, this method requires the toting of heavy, bulky equipment. The bed of a truck is sufficient to transport a highbanker.

Of interest to prospectors who want to enjoy both dredging and highbanking without having to buy two separate pieces of expensive equipment is the dredge/highbanker combination unit. This single unit, with a few minor modifications, will allow you to recover bench gold as well as vacuum up river bottom sediments for "paystreaks" of gold.

Drywashing for Gold

This technique is used in desert areas to separate gold from dry deposits. While rewarding, this technique can be dusty, dirty work, depending upon wind conditions. If possible, the drywasher is set up so that the wind blows dust away from the operators.

This method also requires the need for all-day shoveling. The soil that is being processed must be dry. Any moisture will prevent the drywasher from adequately separating and recovering gold from dirt.

Less expensive drywashers are hand operated and require two people—one to shovel and one to perform the noxious and dusty task of turning a hand crank or pulling a rope to operate the bellows. One person could shovel, stop, and manually operate the drywasher, stop, shovel, etc. This would be doubly exhausting and not worth the effort for long.

Gasoline-operated drywashers are more efficient and, though costlier, are recommended over hand-operated models.

Electronic Gold Prospecting

In addition to sluicing, this is one of my favorites! For a more in-depth look at this technique see my article in the December 2001 issue of *Rock & Gem*, "Gold Prospecting With a Metal Detector."

Gold prospecting with a metal detector requires little physical effort and no gold panning expertise. It can be done in a wheel chair as long as the terrain is not too rough. Many such areas do exist that are not only gold-bearing, but are wheelchair accessible.

Using a metal detector enables you to prospect all types of gold-bearing areas. One is not restricted to areas with or without water.

A metal detector can be wielded creekside as well, allowing you to detect for gold beneath the water's surface. The only caution here is that you do not get the control housing—located near the handgrip—wet. Detector coils are generally waterproof on all but the cheapest models.

Detectors manufactured expressly to find gold may be used to hunt dry desert washes, tailings piles, and to search for caches around old cabins and mines. In addition to gold, they can be used to find coins, jewelry, and metallic relics around old home sites and on beaches.

If you intend to use a detector mainly for the purpose of finding coins and jewelry, I recommend that you purchase one specifically for those uses.

While metal detectors can be costly depending on their intended use and their depth capability, they are well worth the expense if you intend to use one on a regular basis. Left to sit in a closet, a detector will certainly not provide for a return on your investment! Leaving it to sit in a closet precludes you from finding gold and treasure of all types, which is why you bought it in the first place!

By now you can see that there is a gold prospecting technique to fit every level of physical ability, interest and budget.

If you've ever had a hankering to give gold prospecting a try, there is every reason for you to "go for the gold"!

Now is the time: The season is right, your summer vacation is at hand. What better way to spend it than enjoying the sounds of wind and water while experiencing the fun of gold prospecting?

You now know what you'll need and what to do. So, in the words of a top shoe manufacturer, "Just do it!"

Good luck and good prospecting!

Panning along the Rio Grande River

Fifteen Great Spots for Finding Gold and Gemstones

by David and Clois Walker

With many of today's vacationers being attracted by the nation's principal waterways, one of them being the renowned Rio Grande, the family rockhound is happily afforded an opportunity to dip 'n' tip a gold pan or gemstone screen here and there along the way!

The most convenient stopovers, of course, are at the many highway and stream crossings, some of which are on the principal tourist routes. These afford parking areas for picnicking, fishing or whatever else mom and the kids might be interested in, forbearing for a time at least, daddy's indulgence in that other addiction, more disparagingly referred to as "rockhounding."

continued on page 37

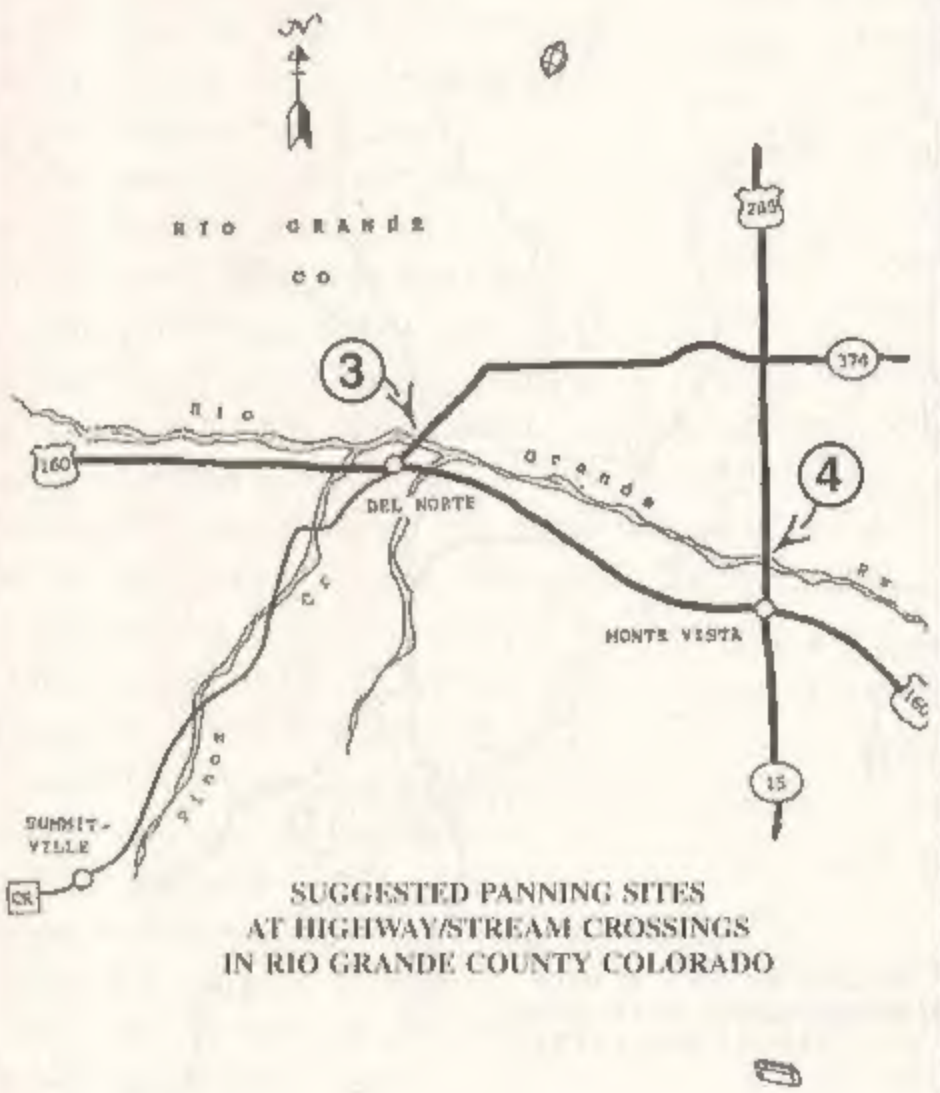
CO1

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN MINERAL COUNTY COLORADO

NM1

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN TAOS COUNTY NEW MEXICO

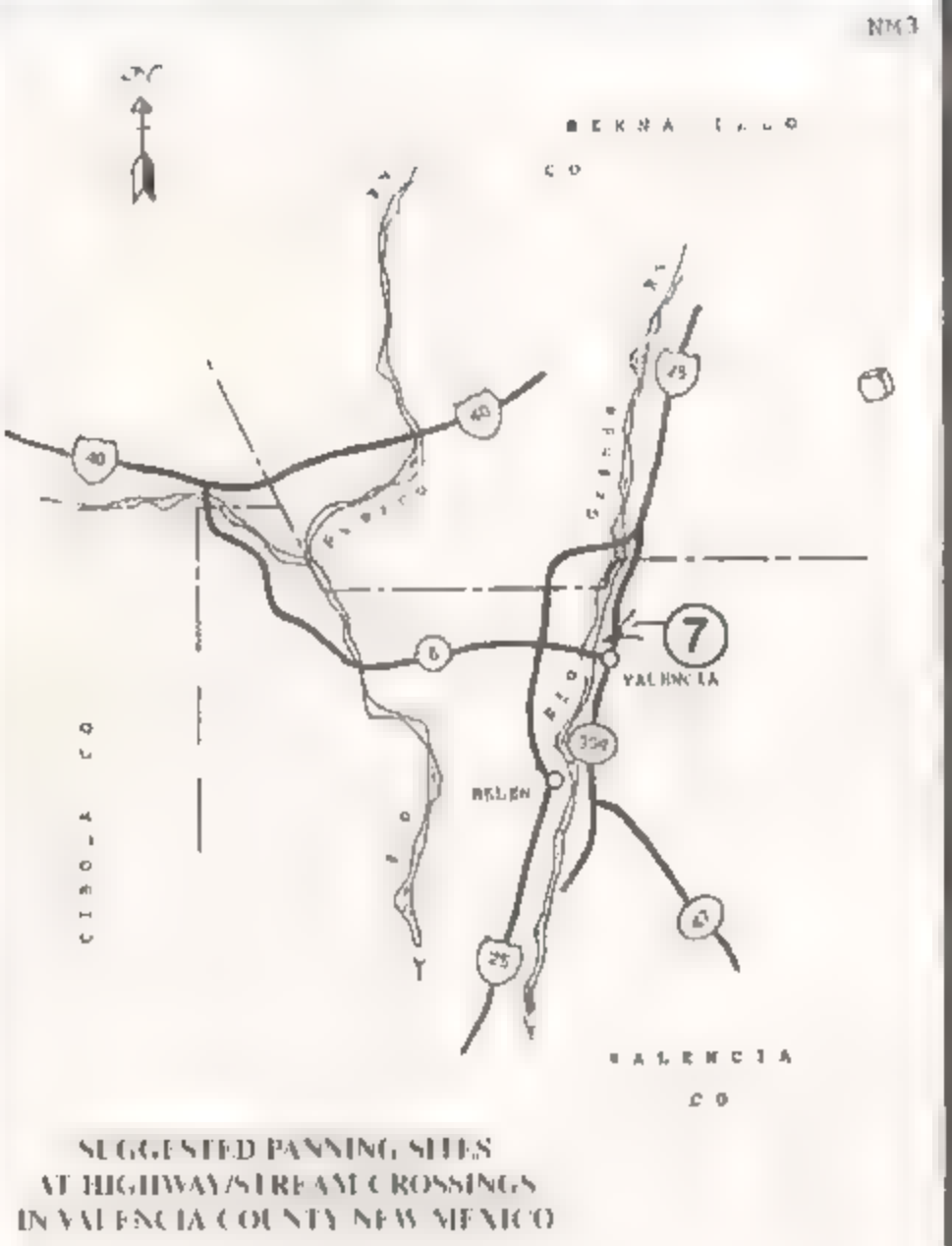
CO2



SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN RIO GRANDE COUNTY COLORADO

NM2

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN RIO ARRIBA COUNTY NEW MEXICO



SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN VALENCIA COUNTY NEW MEXICO

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN DONA ANA COUNTY NEW MEXICO

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN SOCORRO COUNTY NEW MEXICO

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN VAL VERDE COUNTY TEXAS

The potential for finding minerals and gems is undoubtedly present along the Rio Grande as attested to in geologic publications and any number of field guide books all the way from its upper tributaries in Colorado and south along the full length of New Mexico, then angling in a southeasterly direction along the Texas/Mexico border, all the way to its ultimate confluence in the Gulf of Mexico.

Some of the highway and stream crossings encountered along the length of the river are more conducive to transposition of gem- and mineral-laden gravels from upstream deposits than others, where known deposits have proved to be appreciable. By spotting the more appreciable locations on topographical or shaded relief maps then, and tracing the hypothetical float along contributing tributaries, the most promising road or highway crossings become readily apparent.

While basing your chances for success primarily on the premise that "erosion is forever" is undoubtedly less reliable than basing them on personal observation, most rockhounds of our acquaintance have been confirmed enough in the game to give it a try. Certainly, the prospects are brighter than at the many highway crossings where such analyses have not been made!

Correspondingly, we have researched the overall potential in each of the three states traversed by the Rio Grande proper, to the extent indicated on the following summary, together with varieties of the more popular gems and minerals reported on within appreciable distances upstream. On the premise that maps, like pictures, are "worth a thousand words," we have included enough detail to identify each of the 15 panning sites encountered along the way, from north to south (downstream), by state and county. Note also the parenthetical referrals on each map to corresponding areas on the official state highway maps for overall orientation in the field.

Obviously, by limiting panning activities within prescribed highway rights of way, the family is spared the necessity of locating and negotiating terms and conditions with adjacent landowners in order to avoid penalties for trespassing, which could certainly put a damper on a vacation.

Remember, however, while partaking of highway conveniences, the usual safety and environmental standards applicable to rockhounds and tourists alike: stop only where off highway parking is permitted, for example, and use a pan and scoop only, in the normal panning process. Digging in highway embankments is expressly prohibited in most states.

Also to be remembered, even following those occasional gully-washers along the Rio Grande and its many tributaries, is the fact that luck is still to be reckoned with: scarcely ever as cooperative as we'd like it to be!

Site #1: Mineral County, Colorado, CO-149 crossing near Creed. Vicinity finds include agate, aquamarine, gold and tourmaline.

Site #2: Mineral County, Colorado, CO-149 crossing near South Fork. Vicinity finds include agate, aquamarine, gold and tourmaline.

Site #3: Rio Grande County, Colorado, US-374 crossing near Del Norte. Vicinity finds include agate, bloodstone, chalcedony, gold, jasper, opal, quartz crystals and silicified wood.

Site #4: Rio Grande County, Colorado, US 285 crossing near Monte Vista. Vicinity finds include agate, bloodstone, chalcedony, gold, jasper, opal, quartz crystals and silicified wood.

Site #5: Taos County, New Mexico, US-64 crossing near Taos. Vicinity finds indicate gold potential.

continued on page 39

TX2

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN MAVERICK COUNTY TEXAS

TX1

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN STAR COUNTY TEXAS

TX3

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN WEBB COUNTY TEXAS

TX5

SUGGESTED PANNING SITES
AT HIGHWAY/STREAM CROSSINGS
IN HIDALGO COUNTY TEXAS

Site #6: Rio Arriba County, New Mexico. US-285 crossing near Valarde. Vicinity finds include garnet, labradorite and malachite.

Site #7: Valencia County, New Mexico. NM-6 crossing near Valencia. Vicinity finds include agate, opal, opalized wood and silicified wood.

Site #8: Socorro County, New Mexico. US-380 crossing near San Antonio. Vicinity finds include agate, chalcedony, jasper, quartz crystals and silicified wood.

Site #9: Dona Ana County, New Mexico. US-185 crossing near La Mesille. Vicinity finds include chrysocolla, onyx, quartz crystals and turquoise.

Site #10: Dona Ana County, New Mexico. I-10 crossing near La Mesille Vicinity finds include chrysocolla, onyx, quartz crystals and turquoise.

Site #11: Val Verde County, Texas, U S 57 crossing near Del Rio. Vicinity finds include agate, chalcedony, jasper, quartz and silicified wood

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Site #12: Maverick County, Texas, US-57 crossing near Eagle Pass. Vicinity finds include amazonstone, chalcedony, jasper, quartz and opalized wood.

Site #13: Webb County, Texas, U S-85 crossing near Laredo. Vicinity finds include agate and chalcedony.

Site #14: Starr County, Texas, US-2 crossing near Rio Grande City Vicinity finds include agate, chalcedony, jasper, opalized wood and silicified wood

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Site #15: Hidalgo County, Texas, US-40 crossing near Hidalgo Vicinity finds include agate, jasper and silicified wood.

Colonial

These Spanish pieces of eight were recovered from a Caribbean shipwreck. Of the estimated 5 billion troy ounces of colonial silver shipped from the New World, as much as five percent was lost in shipwrecks. (Photos courtesy the author)

Mexico, Bolivia and Peru Share a Rich Mining Heritage

by Steve Voynick

Historians have long attributed the determined Spanish effort to explore, conquer and colonize much of the Western Hemisphere to three primary motives: God, glory and gold. Spain's insatiable appetite for gold inspired the Aztec and Incan conquests, along with legendary feats of exploration that expanded the geographical limits of her New World empire. Yet, even greater social, cultural, economic and technological impacts would accrue from the quest for another metal – silver.

Over a period of 300 years, Spain shipped an estimated 1,000 tonnes, or about 30 million troy ounces, of gold from the New World. But during that same time period, Spain's colonial mines turned out as many as 5 billion troy ounces – 160,000 tonnes – of silver.

Unlike the search for gold, which built no lasting cities, silver built a succession of cities with legendary names like Potosí, Zacatecas and Cerro de Pasco, which still stand as symbols of the colonial silver mining fraction. Much more so than gold, colonial silver supported the Spanish economy and facilitated the rapid expansion of worldwide commerce. Silver also inspired one of history's greatest mining adventures, leaving behind a cultural, monetary and technological heritage that survives today.

Silver was an important Old World metal commodity long before the Spanish arrived in the Americas. Man began working silver in the Mediterranean and Near East regions some 7,000 years ago. The first sources of silver were not native metal, but metallic masses of silver that had been naturally reduced from rich outcrops of argentiferous galena (silver-bearing lead sulfide), by the heat of wildfires.

Given sufficient heat, atmospheric oxygen will combine with argentiferous galena to produce gaseous sulfur dioxide and a molten lead-silver alloy. With continued exposure to high temperatures, a cupellation, or refining, process occurs when oxygen combines with the molten lead portion to form a crust of white lead oxide. The more chemically inert molten silver portion

Silver

Native silver from Batopilas, Mexico. The silver mines at Batopilas have operated since the 1700s.

does not oxidize, but instead sometimes occurs in masses of nearly pure metallic silver. This natural reduction process served as the model for the first fire smelters that treated silver lead ores. For thousands of years, fire smelting remained the only way to extract metallic silver from its ores.

Although native silver has occasionally been mined as an ore, virtually all the silver mined throughout history—an estimated 40 billion troy ounces—has come from such minerals as argentiferous galena, chlorargyrite (silver chloride), acanthite (silver sulfide), and the sulfosalts proustite (silver arsenic sulfide) and pyrargyrite (silver antimony sulfide).

Greek miners developed the world's first large source of silver at Laurium, near Athens, around 550 B.C. The Laurium mines produced about 1 million troy ounces (32 tonnes) of silver per year, with much of it minted into Greek coinage.

Later, the Romans, who mined much of their silver in what is now Spain, introduced the denarius, a coin containing 4.7 grams (about one seventh of a troy ounce) of pure silver, which became Rome's monetary standard.

In the 15th century, underground mines in central Europe's Erze Gebirge Mountains became the world's primary source of silver. Despite this new supply, annual world silver production still never exceeded 1.5 million troy ounces (48 tonnes) per year—not nearly enough to accommodate the monetary demands of the huge expansion in international trade that would soon come with global exploration and the European Renaissance.

Within just three decades after arriving in the Americas, Spain received an infusion of about 4 million troy ounces of gold from the 1521 conquest of the Aztec Empire in what is now Mexico and the 1533 conquest of the Incan Empire in present-day Peru. But this initial flow of gold quickly declined to levels incapable of supporting Spain's global ambitions.

Spain's military power and colonial empire might easily have collapsed within the century had it not been for silver. Spanish prospectors discovered silver in 1534 at Taxco, 60 miles south of Mexico City. A year later, Hernán Cortez, the conqueror of the Aztecs, presided at the opening of the first European hard-rock mine in the New World.

Taxco was much more than an isolated silver deposit. It represented the southern terminus of a highly mineralized geologic rift zone that extends 1,000 miles north to the present state of Sonora. The rift was formed when the Laramide Orogeny uplifted the Sierra Madre Occidental some 65 million years ago. As the Sierra Madres rose, the adjoining crustal section to the east subsided, creating a well-faulted rift. In many places, the faults served as conduits for the rise of magma and associated hydrothermal solutions that emplaced rich, vein-type silver deposits.

This Mexican "silver belt" is the world's richest regional silver occurrence. Through the 1500s and 1600s, Spanish prospectors followed this belt northwest from Taxco, striking rich silver deposits at the sites of the present-day Mexican cities of Zacatecas, Guanajuato, Pachuca, Sombrete and Fresnillo.

Spain was just beginning to realize the richness and extent of its Mexican silver deposits when its prospectors made another silver strike, this time in the Viceroyalty of Peru, 5,000 miles to the south in what is now Bolivia. The surface manifestation of this new deposit was a prominent, reddish, conical hill on the barren altiplano at an elevation of 13,800 feet.

The hill was the remnant of a volcanic dome that, in Tertiary time, had intruded a previously existing, low-relief, maar-type volcanic crater. Within this complex, thoroughly faulted volcanic system, hydrothermal solutions had emplaced five major veins of extraordinarily rich silver ore in and below the hill. Spanish miners named the conical hill Cerro Rico (Rich Hill) and founded the village of Potosí in a nearby canyon.

Incredibly, Spanish prospectors then made yet another major silver discovery, this one at Cerro de Pasco, north of Lima in present day Peru. At about the same lofty elevation as Potosí, Cerro de Pasco was geologically located at the junction of several heavily mineralized faults.

The development of these colonial silver deposits progressed relatively rapidly thanks to a series of timely advances in mining and metallurgy. In 1556, Georgius Agricola (Georg Bauer) published *De Re Metallica*, his compendium of the mining methods used in central European silver mines. *De Re Metallica* conveniently provided the Spanish with detailed knowledge of the then state-of-the-art methods of underground mining.

continued on next page

Colonial Silver *from page 41*

Spain's colonial miners also benefited from the newly developed amalgamation process, which used mercury to dissolve, and thus separate, metallic gold and silver from ores and treated concentrates.

Also important was the development of the chloride leach process that chemically reduced crushed silver ores to metal. Italian metallurgist Vannuccio Biringuccio first described chloride leaching in 1540 in *De La Pirotechnia*, his treatise on metallurgy and smelting. In 1554, a Spanish Dominican monk and miner named Bartolome de Medina introduced the chloride leach process to the Americas at the silver mining town of Pachuca, Mexico.

In the chloride-leach process, miners dumped finely ground, high grade silver-sulfide ore onto a large stone floor, called a patio, and mixed it with common salt (sodium chloride), sulfate of iron or copper, and water. The chlorine ions converted the silver sulfides to unstable silver chlorides, which were immediately reduced to tiny bits of precipitated silver metal. The addition of mercury then formed an amalgam with the free silver. When the amalgam was heated in retorts, the mercury vaporized off and was condensed for reuse, leaving behind silver metal of high purity.

Chloride leaching, which became known as the "patio process," was much faster and cheaper than traditional smelting. While smelting was practical only on ores grading 200 or more troy ounces of silver per ton, the more efficient patio process could profitably treat ores grading only 40 ounces of silver per ton, thus greatly increasing Spain's reserves of silver ore.

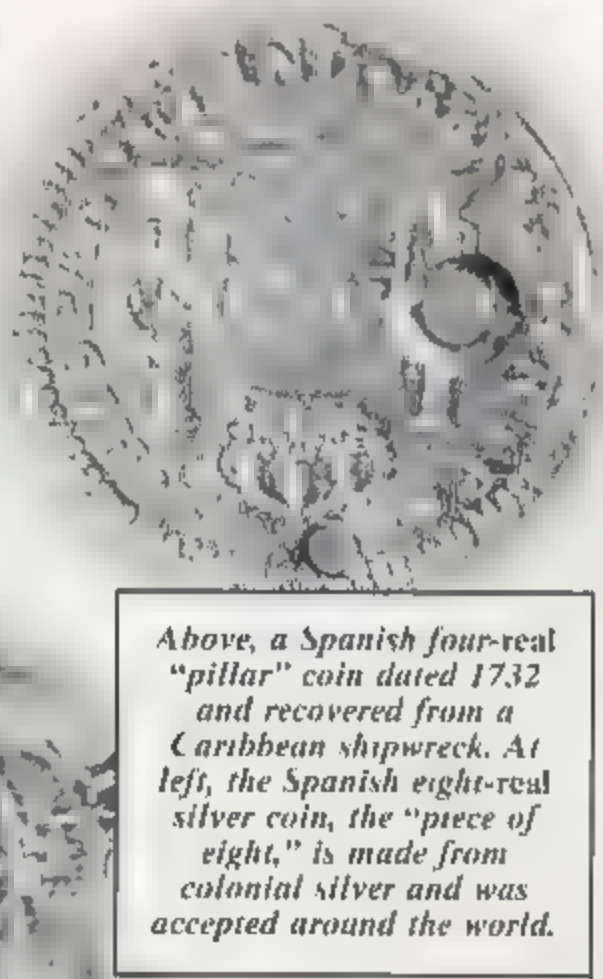
Spanish miners began using the Baytron process, a modified patio process, at Potosí, Bolivia, in 1580. In the Baytron process, stone floors were heated by fireboxes and flues to accelerate the speed of chloride leaching. Because the cold alpine climate greatly slowed the speed of the standard patio process, the heated patio floors of the Baytron process were critical to processing silver ore at Potosí.

By 1590, Potosí was producing some 2 million troy ounces of silver each year. Potosí was then a city of great culture, stunning architecture, numerous cathedrals and even a royal mint. Its population of 200,000 made it by far the biggest city in the Americas.

But Potosí's hundreds of individual mines were, in terms of human suffering, arguably the worst the world would ever see. Unventilated and lit only by smoky tallow candles, the cramped, narrow underground workings were as deep as 1,000 feet. Shafts were fitted with ladders fashioned from hide thongs and wood. When descending, the miners — most of whom were enslaved Quechua Indians — carried enough roasted maize and coca leaf to last for an entire week of breaking rock with hammers and iron bars. At the end of their week, they climbed back to the surface burdened with a back pallet loaded with 100 pounds of silver ore. After only a day of surface labor, they returned to the depths of the Cerro Rico mines.

The Spaniards, appalled at the noise, smoke, and intolerable stench of the dark, hot underground, trained Indian overseers to direct the mining work, only venturing briefly into the underground themselves when their presence was absolutely necessary.

In 1582, to provide workers for the mines, Spanish Viceroy Francisco de Toledo established a forced-labor system called *la mita*, which ordered all



Above, a Spanish four-real "pillar" coin dated 1732 and recovered from a Caribbean shipwreck. At left, the Spanish eight-real silver coin, the "piece of eight," is made from colonial silver and was accepted around the world.

Indian males between the ages of 18 and 50 from the entire Viceroyalty of Peru to work in the Potosí mines for four months of each year. This system was essentially a death sentence for the Quechua men. Between 1572 and 1680, Potosí's best years, 80 percent of Peru's native male population died as a result of mining silver at Potosí. The hide ladders frequently broke from age, wear and rot, pitching bodies, tools and loads of ore down upon those below in the shafts. And after a week in the underground dust, smoke, heat and humidity, Quechua miners emerged into the cold, dry wind of the 13,800-foot high altiplano. Pulmonary disease was rampant, and the few Quechuas who survived the mines usually soon died of respiratory failure.

The Potosí mines required the forced labor of 13,500 Indians annually, with 4,500 working at any given time. Historians estimate the yearly fatality rate at 15 percent, meaning that on average 2,000 Quechua miners died each year.

"Every peso coin minted at Potosí," Spanish historian Fray Antonio de la Calancha wrote in 1635, "has cost the lives of 10 Indians who have died in the depths of the mines." De la Calancha's estimate was not far off, for historians agree that as many as 1 million Indians died while mining, or as the result of mining, at Potosí.

Conditions in the thousands of Mexican silver mines in Zacatecas, Guanajuato, Pachuca, Sombrete, Fresnillo, Taxco, Batopilas, Arizpe and San Luis Potosí (named for Potosí, Bolivia) were somewhat better due to a much milder climate, lower elevations, more plentiful food, and generally shallower mines. Nevertheless, these mines also claimed the lives of many miners, most of whom were Purepecan Indians.

During the 1600s, Spain's colonial mines accounted for 85 percent of world silver production. Between 1540 and 1800, Mexico produced 1.5 billion troy ounces of silver; Potosí, Bolivia, 1 billion troy ounces; and Cerro de Pasco, Peru, 700,000 troy ounces. The total official (meaning taxed) production amounted to 3.2 billion troy ounces, or roughly 100,000 tonnes of silver. But since smuggling, theft and fraudulent record keeping were common in the colonies, historians believe that actual production was closer to 5 billion troy ounces, or roughly 160,000 tonnes.

Most colonial silver was minted into coins or poured into bars. Bars weighed 80 pounds each and were stamped with marks indicating weight, purity, mint of origin, and proof of tax payment.

During the colonial era, Spanish mints in Mexico City, Potosí and Lima turned out hundreds of millions of silver coins. At that time, Spain's basic currency unit was the *real*, a coin containing 3.54 grams of fine silver. In 1572, as silver production soared, mints began producing coins in denominations of one-half, one, two, four, and even eight *reales*, the last becoming known worldwide as "pieces of eight," or "ochos." Mint workers poured molten silver into long, shallow molds about 1 inch wide, chiseled off pieces roughly an inch square and on average weighing a bit less than a troy ounce, then chiseled the edges of each piece to generally round the coin. Finally, the coins were struck with obverse and reverse designs, then packed in sacks and shipped.

By 1620, pieces of eight, both in number and popularity, had replaced the old Joachimthaler coins of central Europe and were universally accepted in Europe, Asia,

Africa and the Americas. In 1730, the piece of eight was replaced by the "pillar dollar," a 1-ounce numismatically refined, round silver coin that became known as the Spanish dollar." On the reverse were two architectural columns, representing the Pillars of Hercules at Gibraltar, around which twisted ribbons bearing Latin inscriptions. When bookkeepers of the period needed a symbol for this standard currency unit, they used two vertical lines for the pillars with a simple "S"-shaped swirl for the ribbons—the origin of our modern dollar sign.

Spain reaped no lasting economic benefit from its fortune in colonial silver. Unable to build a self-sustaining economy, it merely traded the silver away to other nations. Much went to the Dutch, who then controlled the spice trade via the African route and who passed it on to India and nations in the Far East. A secondary flow of colonial silver also reached the Far East directly from Mexico. Between 1565 and 1815, Spanish galleons made an annual round trip between Acapulco, Mexico, and Manila in the Philippine Islands, carrying colonial silver west, and returning to Acapulco with spice trade goods that were transshipped to Spain.

While gold served primarily as the exchange medium of nations, silver was the exchange medium of merchants, and Spanish colonial silver became the currency that facilitated the enormous expansion of international commerce during the 16th, 17th and 18th centuries. Colonial silver even helped shift the balance of world political power. The flood of colonial silver contributed to the decline of Islam by undervaluing the value of the popular Ottoman silver akce coin.

Colonial silver was also the model for the standard currency unit of the newly independent United States. Since the Spanish dollar was widely circulated and enjoyed great public confidence in the American colonies, its name, style and weight were copied when minting the silver dollar, the standard coin of the United States of America.

Although Spain's colonial empire collapsed in 1820, silver mining survived. And over nearly two centuries, advances in mining and extraction technologies have boosted production significantly. Mexico now leads the world in annual silver production with 88 million troy ounces, just ahead of Peru with 78 million troy ounces. Together, these two nations account for one third of the current world output of silver.

Today, all the major silver mining towns in Mexico that date back to the colonial era have vibrant economies. Tourism especially in cities like Zacatecas, Guanajuato, Taxco, and San Luis Potosí supplements the income derived from many active silver mines.

Potosí, Bolivia, however, has not fared as well. Visiting Potosí in the 1970s, I found winding, narrow streets lined with beautiful but faded colonial architecture, fine churches, and several interesting museums. But most of the city's 120,000 residents were poor Quechua Indians, many of whom, in the long and tragic tradition of their fathers, still worked in the mines. Two mining companies were then active, one processing colonial-era tailings for silver, the other mining new underground ore from Cerro Rico.

But these mining companies pulled out in the 1980s when silver prices fell. To address high unemployment, the Bolivian government soon stepped in to help local miners establish cooperatives. Dozens of small groups of miners now lease entire mines or sections of mines, in which workings may be hundreds of years old. Operating on shoestring budgets and with no concern for health or safety, these miners pursue the same silver veins that the Spanish once mined. Unfortunately, most labor is still performed by unskilled Quechua Indians, who work backbreaking 10- and 12-hour shifts for subsistence wages, in conditions not far improved from those endured by their ancestors.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has designated Potosí a World Heritage Site and hopes to restore many colonial-era buildings and preserve what is left of Cerro Rico itself, which has become a Peruvian national symbol.

But mining corporations have other plans. One company wants to turn Cerro Rico into an open pit mine to extract as many as 300 million troy ounces of remaining silver, an approach that would literally destroy the entire hill. Another company wants to mine the pallacos, deep deposits of unconsolidated gravels eroded from the flanks of Cerro Rico and containing some 70 million troy ounces of silver. The Bolivian government seems divided between developing the tourism potential of a World Heritage Site and supporting corporate mining to boost local employment.

Interestingly, one of the silver extraction methods recently used at Potosí and other high-elevation Bolivian mines is the Buyron version of the patio process. Basically unchanged in principle, this colonial-era extraction process has proven even more efficient than modern cyanidation in cold-climate silver recovery.

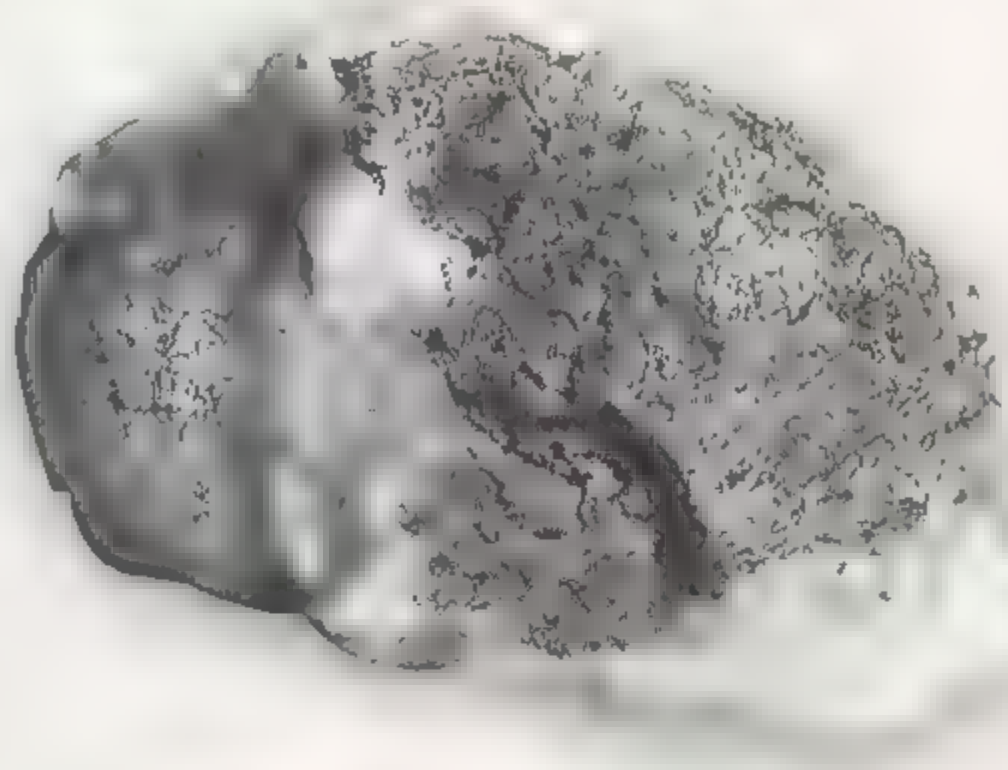
Only time will tell what will happen at Potosí. But because exploration geologists in Mexico, Bolivia and Peru have identified ore reserves containing several billion troy ounces of silver, and are continuing to find new reserves, one thing is certain. The final chapters of one of the world's greatest mining adventures are still to be written.

MILESTONES

by John Sinkankas

The Origin of Agate

The first agate I ever saw was a broken nodule that I found as a child in Braen's Quarry at Hawthorne, near Paterson, New Jersey. Braen's was one of a string of "trap-rock," or basalt, quarries dug into the sides of the Triassic lava sills that form so striking a feature in the northern part of the state. The big trick in choosing where to open a quarry was to look for basalt that was already filled with cooling cracks, so that it would break down to piles of angular rocks when blasted down. The blocks could easily passed into the crusher to eventually emerge as concrete fill or road ballast. Less desirable from the quarryman's standpoint was pillow basalt, rolled masses of pasty basalt that froze into pillow shapes and between which were cavities lined with all sorts of quartz, calcite and zeolite delights. Most of the pillows broke up during blasting, but some remained huge in size and had to be set aside because they could not be accommodated by the crusher. These were later drilled and dynamited to break them up into smaller fragments. A nice bit of judgment was called for in this operation: too little explosive and the shot was wasted, too much explosive and fragments were liable to fly long distances as dangerous projectiles. Mostly, the boulders were festooned with sisal mats to prevent flying fragments, and when blasted, it all collapsed like the Wicked Witch of the West into a pile of rubble now fit for the crusher.



My agate, picked up from the floor of the quarry, was typically Patersonian: pale gray with very thin and sharp white lines circling it about in near parallel rings. The material between the bands was so highly translucent that the rings seemed suspended in air, and as I moved the nodule, they would shimmer and wink as if having a life of their own. This utterly fascinating optical illusion was heightened all the more when the surface was wetted with a bit of saliva.

Many years later, still captivated by the lure of agates and after considerable reading on the subject of agate formation, I wrote an article entitled "What Do We Really Know About the Formation of Agate and Chalcedony" for *Lapidary Journal* (Vol. 15, 1961, pp. 554-556). I had a simpler title for the article, but then editor Hugh Leiper could not resist embellishing almost every headline that came his way, mine being one of his victims. In this article, I rounded up various theories on agate formation, the most bizarre being one by a German geologist who suggested that globs of pasty silica were present in basalt flows and when it all cooled, the globs sorted themselves out into banded agates. Needless to say, this theory did not get far and most authorities now agree that the quartz or silica that eventually fills gas bubbles in basalt or similar volcanic rocks must have been introduced via water solution.

Nevertheless, the idea of infusion of silica through the solid rock surrounding the cavities was disturbing. How could all that silica pass through a fine grained rock, which if anything should act as a filter and trap the silica before it could migrate? Then someone found agates that had narrow channels leading from the outside through the wall and into the central part of the nodules -seeming proof that the nodules, perhaps like gourds on a vine, were interconnected by channels through which the silica rich solutions passed. For a while, this was hailed as the long sought explanation for how the silica got into the cavities. Alas, that theory, too, didn't last, long as excavation of nodules from various deposits showed that by far most of them had no "channel" connection at all, each had grown independently with no external sign of interconnection. Back to square one.

At the moment, we really do not have any kind of evidence to account for the source of the silica that forms the cavity fillings, but I think there is a possibility of discovering some facts about the process if several young and vigorous earth scientists can be persuaded to carry out the following investigation.

Find a large basalt quarry with a working face studded by agate nodules. Sample the rock in between the nodules and in a vertical direction. Analyze these samples for silica content. The idea being that if the silica infused the cavity from immediately outside, then there should be an aureole around each agate nodule that is impoverished in silica. In other places in the rock, far away from nodules, the silica content may be relatively high and it may perhaps be possible to estimate how much silica could be derived from outside to account for that found inside the nodules.

The following references include discussions of agate origins.

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LAPIDARY LORE and MORE

Saluting Some Pioneers

by June Culp Zeitner

Not many were trying intarsia in the 1950s, but Roberta Herrick of Colorado made a name for herself with her mineral mosaics. (Photos courtesy the author.)

Rock & Gem readers are in for a special treat. This month marks the debut of Lapidary Lore and More," a column by June Culp Zeitner. Much to the delight of all of us, June is now a regular contributor to Rock & Gem.

Those of you who have been around a few years have certainly read of June's wonderful adventures in rockhounding. It seems she has been everywhere, done everything, knows everybody and has accomplished everything a rockhound dreams of doing. And now she intends to share all this with us.

June has been rockhounding since before World War II. Her articles and writings have fascinated readers for years. And her efforts have gone beyond the printed page. She is largely responsible for establishing the Rockhound Hall of Fame in Rapid City, South Dakota. She has been recognized in a variety of ways including having one of North Carolina's finest gem emeralds, now in the Smithsonian collection, named for her. The June Culp Zeitner emerald is a superb 15.46-carat kite-shaped gem, one of America's rarest and most exquisite gems. That description is well applied to June herself.

June is still an enthusiastic show visitor, enjoying the hustle and bustle of visiting friends, seeing exhibits and exhausting those who try to stay with her.

Now through her column, June will be sharing her extensive adventures while bringing us insights into our hobby's development. We are truly blessed to have June with us. Welcome aboard friend!

Bob Jones

"Lore" refers to learning or knowledge, and we are all interested in that. However, don't be surprised if history, biography and legend creep into my column now and then. So, although I do have some recent facts and tips to share, I'm going to start with a look at our past.

I am gratified to see that some of the greatest lapidary work ever is currently being done in the United States. How did we get to this point where the lapidary hobby and professions are recognized as fine art? The same way that any group finds success—through its pioneers! Here are a few we honor.

Henry Dake was a dentist who changed his career from polishing teeth to polishing gems. A prolific writer starting in the 1930s, we still use his books.

George Kunz, a Tiffany gemologist, was instrumental in locating and promoting American gemstones, among them, beryl, sapphire, tourmaline and spodumene (kunzite).

James Kraft. Yes, the cheese man himself, was a lapidary and jade hunter who made jade jewelry for his employees and a jade window for his church. Among his contributions was making the Chicago area unusually interested in lapidary.

Bob Harvill was an oil field worker whose son gave him a chunk of jade for Christmas. He improvised some machinery, made some tools, and started one of America's most successful gem carving careers.

Olive Colhour had some acquaintance with machinery, having worked in a torpedo factory during World War II. After that, she was a busy housewife who was invited to a lapidary display in Los Angeles in 1946. I have to say the rest is history. She soon mastered cabs, carving, intarsia, and several innovative techniques such as creating a bowl of gem flowers that could be rearranged at will. Featured at many shows, her breathtaking displays took up about 60 linear table feet.

* * *

What is lapidary? Each of us has a specific picture in our mind of just what the word really means. Webster's defines it as, "A cutter, polisher or engraver of precious stones other than diamond." This is a little too narrow, because until very recently few stones were considered precious. *A Dictionary of Geological Terms* says, "A skilled workman who cuts and polishes gems or other stones." That's more like it. A friend of mine prefers to call a lapidary, "A person who works with stone to enhance it for a specific purpose." There is some truth to all these definitions.

Gemstone intarsia ranks as a special top lapidary art. Carvings can be the greatest of the lapidary arts or even the fine arts. Carvers are lapidaries, but so are those who make cabs, faceted stones, combination cuts, vessels and utensils, spheres and beads, bookends, clock faces and other household objects, miniatures, models, monuments and memorials, mosaics, scrimshaw, countertops and even bathroom fixtures, such as tiger's eye faucet handles.

Does great stone carving include Mount Rushmore? I think it does. The pink marble Box Tower in Florida is lapidary work. So is the Taj Mahal.

Do the artists who are using drusy or botryoidal specimens instead of polished cabs count as lapidaries? Of course they do. They don't just pick up a broken piece of drusy material and transform it immediately into jewelry.

We should use the word "lapidary" more often so people get an idea of how important it is in our lives. I'm tired of new acquaintances asking, "Lapidary? What's that?"

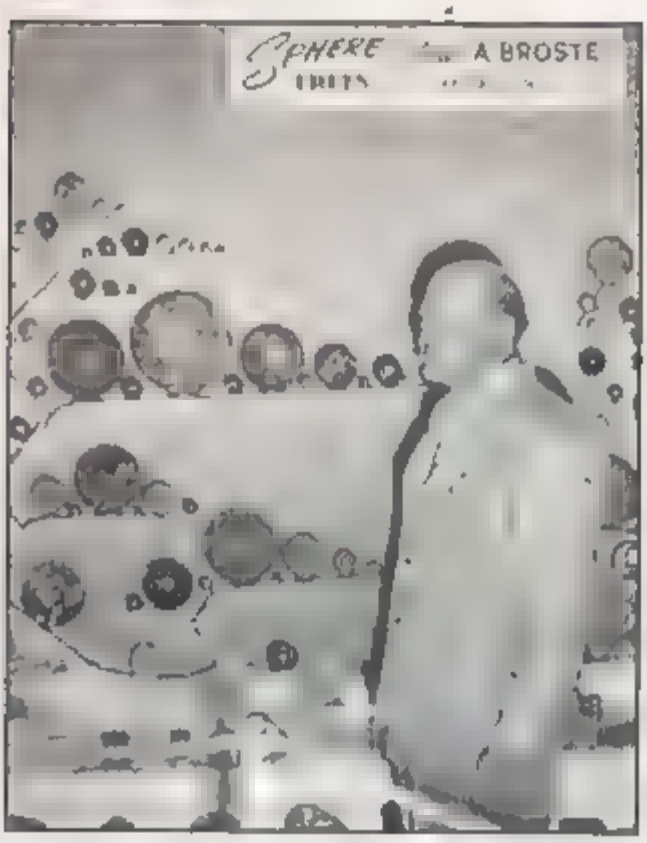
* * *

Chip of the Month. Carvers often find that deep grooves and tight places in carvings are difficult to sand. Many form

w d points for these spots and use the usual series of grits. A new sander, which looks like a fountain pen, has grit-filled fiberglass points. It sands tight spots, nicks and scratches. The glass tip may be extended to the precise area and an extra tip is included. Called Nick-Sander, it is made by Nicsand Inc. in Cleveland, Ohio.

* * *

Every time I went to Mexico I came back with rainbows captured in jelly opal. Some of it was soon crazed. I found that if part of a large piece was not crazed, I could make a cab that would not (or hardly ever) craze from it. Cut a high dome for the top and a low dome for the back. Use fine-grain sanding cloth only, plus plenty of water — not too cold. Do not polish the bottom after it is sanded. The top can be polished with cerium oxide (or your choice) on leather backed with foam.



Paul Broste, who perfected spheres in the 1940s, displayed his giant sphere trees at many shows.

* * *

Some lapidaries flatten the bottom of their cabs using the sides of their grinding wheels. Others object strenuously to the practice. It is all right to use the wheel in this way as long as the sides are still flat. The sides will remain flat if only used occasionally and with care.

It is not hard to change wheels on modern machines. Keep a separate wheel for bottom grinding and flattening cabochons. Anyone having trouble with this stage of sanding should practice by keeping the stone in constant motion just below the front edge of the coarse wheel nearest the cutter.

Personally, I use the sides and I don't dop. Sorry, but that's the way I learned in 1937. Later, I learned to cop small stones, but decided cold dopping is faster, easier, and more reliable. Successful lapidaries learn all the tried-and-true basics and then soon find their own ways to transform rough materials into the stones of their dreams.

"Needle" Minerals

Delicate, But Beautiful

by Bob Jones

Everyone likes to specialize when they collect minerals. It's almost a necessity these days with prices being what they are. Some folks stick to a couple of localities. Others prefer to study a chemical group like carbonate or silicate minerals. Still others collect just one species like calcite, quartz or wulfenite. Whatever your interest, limiting your collecting interests is a way of becoming an expert in a particular endeavor while staying close to a budget.

One type of mineral I have never seen collected exclusively is acicular and fibrous crystals of minerals. There are plenty to choose from and some are almost inexpensive, the wonderful acicular zeolites from India, for example. There are probably a couple of reasons for not concentrating on acicular and fibrous crystal groups. They can be really fragile for one thing. I know I hate to buy a specimen only to see it get damaged later. In the same vein, dealers for the most part do not like to handle acicular crystals because of the risk of damage. I've actually seen people who know nothing about minerals reach out and touch a group of fragile needle crystals to see whether they are sharp or soft, or for some other stupid reason.

Another reason these minerals are overlooked is that most collectors are under the false impression that acicular and fibrous crystals are white or colorless. Let's face it. Color is a very important aspect of collecting for most people. Just watch the folks who cruise along the special exhibits at a show. A case of white minerals gets a disinterested glance, but fill a case with brilliant blues, greens, yellows and reds, and everyone stops and looks again, this time more carefully.

Certainly nothing is more attractive than a nice coating of bright and colorful crystal needles of aurichalcite. (Photos by Evan Jones)

The lack of interest in fibrous minerals is understandable, as many occur in rather dull, matted masses that are not as showy or spectacular as a fine crystal spray often is. Well, I've got news for you. There are plenty of colorful and showy needle and fibrous minerals. You may not think of some of them as being fibrous, yet they

...play an important role in the gem and lapidary field. So, this article is a plug for those much abused, often ignored species of the mineral world: the acicular and fibrous minerals.

What species are we talking about here? I'm sure you immediately thought of things like delicate white sprays of mesolite and natrolite, or pectolite, mordenite, asbestos, and actinolite when you first started reading this article. And they do fit the category. There's even one member of this group that is so matted and fibrous it is nicknamed "mountain leather." That's the mineral palygorskite.

But maybe you didn't think of nephrite jade, millerite, rutile, cuproskhodowskite, cyanotrichite, tiger's eye, and charoite when the question was raised. And yet, there isn't a person going who doesn't find at least some of these fibrous or acicular minerals from this list as very colorful and extremely attractive when used in jewelry, lapidary work, or displayed at mineral shows. The fine charoite and jade carvings we all admire owe their toughness to their fibrous nature. On the other hand, minerals like aurichalcite, cyanotrichite or chalcotrichite can be among the most attractively colored minerals we display. So there's plenty of opportunity to specialize in this group of minerals for a variety of reasons.

Such minerals range all the way from efflorescents that form on tarnished walls and are easily broken off by breathing hard on them to the tough nephrite jade that resists even the most powerful hammer blows. Except for collectors who have a scientific bent, the most fragile acicular and fibrous minerals hold little appeal. Therefore, comments on the more collectable of these species would seem more appropriate.

Charoite is one of the newest of the colorful lapidary materials. It wasn't known at all until about 1949, when a few specimens were brought out of Siberia. Russian scientists mounted an expedition into the Murun Massive area northeast of Lake Baikal to seek out its source and by the mid 1950s studies of this lovely violet-hued rock were underway. So far, some 13 different minerals have been identified in the rock, a 500 million-year-old outcrop that formed deep within the earth's crust. Its color is due primarily to the mineral that is also called charoite.

Charoite can occur in a variety of forms. It can be solid, massive, silky, fibrous or matted. In fact, almost any form that is the result of hairlike crystals interlocking in patterns. It is most often intimately associated with other minerals like aegirine, canasite and the like. These contribute to the lovely patterns seen in the massive rock. The material is hard enough to be carved and compact enough to take a good polish. It is very much like nephrite in its lapidary characteristics.

Nephrite, of course, is probably as old as the science of minerals. Long revered by the Orientals, who revere anything green, it has probably been worked into carvings longer than any other mineral. To the Orientals, jade is the link between life and immortality. Jade is, of course, not a mineral at all but a tightly intergrown, matted rock mass of interlocking fibers of actinolite and related minerals. Actinolite is a calcium, magnesium, iron silicate.

As nephrite, it can be white, but is usually green, often with dark specks of impurities. Jadeite, the other form of jade, is basically tremolite, which contains the same elements in nearly the same proportions as actinolite. The difference is in the ratio of magnesium to iron in the structure. Still, tremolite is another fibrous mineral forming a matte of interlocking crystals to give us jadeite. The two are members of the amphibole group of minerals that are most often seen as rock-forming minerals rather than discrete crystals.

continued on next page

Nephrite jade varies some in color, but its composition is always a tangle of needles. (Photo by the author)

Nothing is prettier than a fine spray of legrandite needles from Mapimi, Mexico (above). When chlorite fibers coat a crystal, which is then enclosed in a later crystal, a phantom is the result. (Photo by the author)

"Needle" Minerals *from page 73*

Nephrite is the more common of the two gem materials. Jadeite seems largely confined to Southeast Asia and China while nephrite has been mined in China, Central America, New Zealand, Wyoming, Oregon, Canada and Alaska. Huge masses are still being found in Canada and Alaska and skin divers can still do quite well mining chunks off the beaches of Oregon.

Also worthy of note are the variety byssolite and polygorskite. Both are in the actinolite tremolite series. Byssolite is best known when associated with epidote and quartz. It is found as randomly growing mattes of greenish hairs with and in quartz in the Swiss Alps. From the classic epidote locality at Untersulzbachtal, Austria, long hairlike fibers of byssolite are found, sometimes penetrating the fluorapatites that are found in rare instances with the location's spectacular epidotes.

Palygorskite is actually quite common, but as insignificant white matting in some serpentinite rock formations. The most important exception to this in the United States is at Mcalpine Falls, Washington, where it occurred in huge sheets attached to sharp calcite and barite crystals.

Closely related to the jade minerals is our old friend asbestos, another nonmineral that is actually riebeckite. What makes this fibrous mineral exciting is quartz, which can invade the silky fibers of the mineral, replace them and form a hard, multicolored pseudomorph we call tiger's eye. Other names have been applied to the stuff when it is blue or reddish, but it's all really quartz pseudomorph after riebeckite, another fibrous actinolite.

Another fibrous mineral that has been much used by the lapidary is satin spar, another name for fibrous gypsum. A huge deposit of this material in Egypt gave that early civilization beautiful and easily worked gem rough, from which craftsmen carved unguent jars, busts, figures, vases, and all sorts of decorative things. We still occasionally use it today, but largely as an inexpensive practice material for the beginning lapidary.

Quartz, of course, plays host to any number of minerals in fibrous form. It can enclose needle crystals of chlorite, tourmaline, members of the actinolite-tremolite group, and more. Perhaps its most spectacular companion species is rutile for rutilated quartz is very popular in jewelry and carvings. The brilliant gold to red needles of rutile that grace the interior of many quartz crystals add a marvelous artistic touch to an otherwise ordinary clear quartz. Delicate sprays radiating needles, and thick mattes of rutile provide the lapidary with plenty of options when fashioning quartz jewelry stones.

Rutile is also a very significant mineral in some of the most valuable gems. Infused into a sapphire, ruby, garnet or other brilliantly colored stone, an extra feature appears in the form of a six-rayed stone in the first two and a four-rayed star in garnet. This enhances the value of the stone considerably, as star stones rank among the most valued.

Another interesting feature seen occasionally in quartz is its phantom quality, in which a crystal forms, then gets dusted with fine, sometimes microscopic needles of one of our subject minerals, like chlorite or tourmaline. Then, a second crystal growth of quartz develops over the first. The result is a nicely outlined inner crystal that often mimics the shape of the overgrowth. This can happen several times in the same crystal and a repeating phantom is observed.

Calcite is another mineral prone to inclusions of needle crystals. Most valued may be the fibrous green malachite or brilliant red chalcotrichite occasionally trapped in calcite in a copper deposit. The best known are the Bisbee specimens but an occasional calcite loaded with inclusions has come from the Ray, Arizona, mine and several of the African deposits.

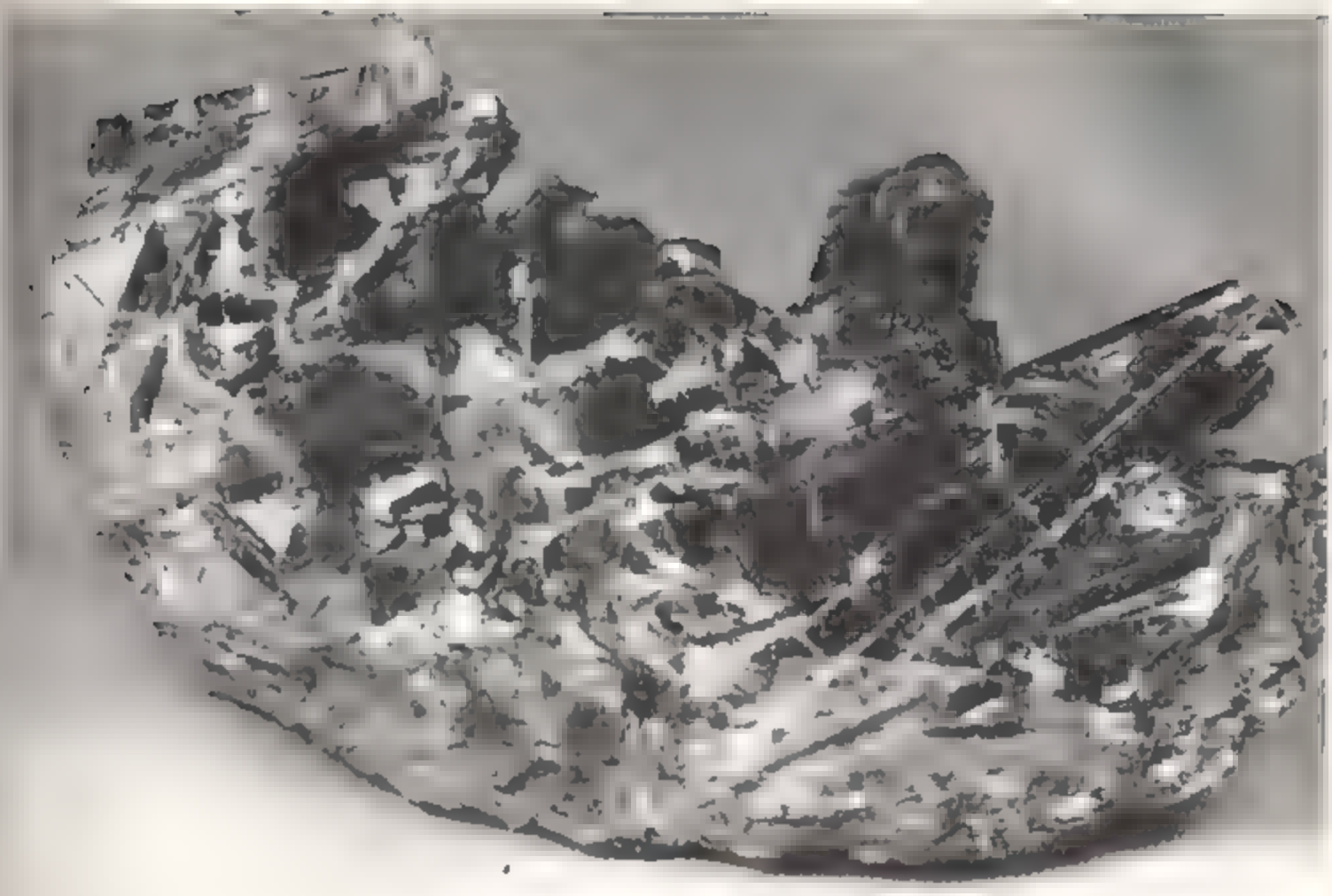
Yet another acicular mineral, aurichalcite, is found in the Southwest, commonly enclosed by calcite crystals. Always a lovely and delicate blue color, the aurichalcite makes a most attractive specimen, especially since the calcite protects the very delicate and soft mineral from being bruised.

Among the acicular minerals, my favorite is millerite. The classic locality is Antwerp, New York, long since mined out. Here, the bright, brassy needles of millerite reached several inches in length and formed in lovely diverging sprays of needles. Smaller crystals once came from some of the mines in Germany. In a road cut at Hall's Gap, Kentucky, collectors were once able to dig small geodes of quartz that would sometimes be packed with matted millerite. Once in a while the matted needles showed a rich green color and were identified as zaratite, a nickel carbonate, which undoubtedly altered from the original millerite, a nickel sulfide. The geodes of Keokuk and surrounding environs in Iowa also produced geodes in quantity, some containing small needles of millerite.

A lot of "fuzzies" could be included on our list here. The marvelously colorful emerald green cuprosklodowskites from Zaire are well worth collecting, in spite of being a radioactive mineral. The finest specimens are completely covered with a thick blanket of needles, seldom an inch long. The richly colored mineral was named after Marie Curie, whose maiden name was Marie Sklodoska for her Nobel prize-winning work with radioactive minerals. Other fuzzies include cyanotrichite, the bright-blue, velvety mineral found in some copper deposits, and brochantite, an emerald-green copper mineral often found with cyanotrichite. They make a great combination when they occur on the same specimen.

Hydrozincite is another mineral commonly found as tiny needle clusters in secondary zone deposits. It is usually snow white in color and can often fluoresce nicely. And if you really want to collect some

Though we like malachite that can be carved and shaped, it can also occur as hair-like needles. (Photo by Evan Jones)



Actinolite is the main species making up nephrite, a tough, usually green form of jade. (Photo by the author)

flang rare try to find a specimen of kermesite, an antimony sulfur oxide. It is a wonderfully rich red color and forms in sturdy needles, which can reach an inch or more in engh. The problem is that it's decided ly uncommon. It occurs very rarely in antimony deposits with stibnite and related minerals. The classic but exhausted localities are the Erzgeberge, Germany, and what was once Rhodesia in Africa. It has also been found in Hungary, Czechoslovakia, Canada, and in a couple of minor occurrences here in California and in Idaho. A little has come from Mexico, and I have hopes that a new antimony deposit that is yielding some handsome stibiconites in lovely buff yellow sprays pseudomorphed after stibnite just might yield some of this rare red acicular mineral.

Most of what I have described here is colorful, which is one of the features I find exciting about minerals. But we should include the fantastically beautiful, snow-white needle sprays of the zeolites, most recently coming abundantly from India. Much of that country is a huge basaltic plateau known as the Deccan Trap. The volcanic rocks make for excellent building material, so quarrying is a major industry around the large cities of that country. And volcanic flows are the favorite haunt of the zeolites, low temperature silicates whose solutions migrate into any available opening in the lava where they form and wait for the quarryman to open up the crystal-filled vug.

There are actually more zeolites than I care to count—more than 50 of them. And many develop as needle crystals. Of these, a handful provide us with spectacular sprays of clear to white needles that can reach 6 inches in rounded sprays that contrast remarkably with their host rock or mineral. Best known are natrolite, mesolite, mordenite and scolecite. You'll come across specimens labeled pseudomesolite. This is a discredited name and suggests there is still disagreement among those who dole out species names. The large size, delicate crystal arrangements, and aesthetic look of these zeolites make them eminently collectible.

Of course, if you really want to get into the costly stuff you can always go after specimens of ludlockite, of which there are only a few dozen, or legrandite, which is quite abundant but very expensive. Ludlockite was found in Tsumeb, Namibia. It forms in gorgeous orange-red sprays that are very delicate and usually very small. The rarity of this species precludes any but the most serious collectors. Legrandite forms in diverging sprays of needles that are a magnificent yellow color. Usually set on a brown iron oxide matrix, these specimens are particularly showy.

The acicular and fibrous minerals certainly offer enough variety among them to satisfy everyone from the most talented jewelry artist to the beginning collector, from the lapidary to the mineralogist. If there's a problem with some of these minerals it's their fragility. They are very often brittle or extremely soft and readily show damage, even from the gentlest touch. Still, others are sturdy and tough enough to yield great artwork under the tools of the artist. Some are showy and take rough treatment in stride. Surely, among this broad group of interesting species you'll find something that will give you pleasure, expecting nothing in return but appreciation.

ROCK SCIENCE

by Steve Voynick

Meteoritic Mysteries

by Steve Voynick

Prior to the early 1800s, the origin of meteorites was one of nature's greatest mysteries. That's understandable, because the concept of stones and metal, often of considerable weight, falling from the skies, simply defied all logic.

References to meteoritic falls are not uncommon in ancient writings. Some biblical scholars believe that Joshua 10:11, which tells of "stones from heaven" killing the enemies of the Israelites some 3,000 years ago, is the earliest record of a meteoritic fall. Chinese literature records a dozen falls dating to 687 B.C. Classical Greek and Roman authors mention at least four falls.

Accompanied as they are by thunderous noises, brilliant lights and smoke trails, meteoritic falls undoubtedly caught the attention of ancient peoples. In antiquity, recovered meteorites often became objects of superstition or religious reverence. In 204 B.C., a meteorite once worshipped in Asia Minor was brought to Rome amid great public celebration. Later, Muslims kept a sacred meteoritic stone in the Kaaba at Mecca. In the New World, archaeologists have found meteorites in Aztec temples and among the sacred relics of a number of Native American tribes.

The earliest meteorite whose place and date of fall is known came to Earth on November 7, 1492 in the French Alsace region. The first documented meteoritic investigation took place in 1576, when a Spanish military expedition tracked down a large mass of metal that had been reported by indigenous people in Argentina's Chaco region. Although the natives were certain that the metal had fallen from the sky, the Spaniards instead assumed it to be the outcrop of a large, metallic ore deposit. After a blacksmith identified the metal as mostly iron, the Spaniards named the site *mineru de fierro* (iron mine).

The same meteorite again attracted Spanish attention in 1774, this time after indigenous tales described the iron as being rich in silver. A Spanish expedition investigated the huge, flat piece of metal, estimating its weight at 23 tons and noting with interest the silvery sheen of its fresh fracture surfaces. Spanish assayers, limited to the era's crude analytical methods, opined that it did indeed contain 20 percent silver.

The Spanish futilely attempted to extract the "silver" through amalgamation. After a new analysis indicated that only iron was present, the Spanish named the mysterious boulder *Mesón de Fierro* (literally, "great table of iron"). Again, the natives insisted that the *Mesón de Fierro* had fallen from the sky, while the Spanish now attributed its origin to a distant volcanic eruption.

Samples of the *Mesón de Fierro* and detailed Spanish reports reached European scientists including the German physicist Ernst Chladni (1756-1827). With a deep interest in meteoritic falls, Chladni had compiled reports from many countries in which observers consistently described the same phenomenon: fireballs flashing across the sky, which sometimes seemed to fall to Earth as fragments of stone or iron.

In a 1794 book, Chladni proposed that meteors were actually small bodies of iron and stone circulating in space that became visible upon entering the Earth's atmosphere because of friction generated incandescence. Chladni was the first to challenge the age-old doctrine that solid bodies could not fall from the sky, and the first to identify the celebrated *Mesón de Fierro* as a meteorite.

In 1799, French chemist Joseph-Louis Proust (1754-1826) studied a *Mesón de Fierro* sample, noting its shiny fracture surface, lack of rust, and ductility. He correctly determined that it contained 90 percent iron and 10 percent nickel. Proust further predicted that if iron and nickel were combined in the proper proportions, the resulting alloy would not rust—the first hint of modern metallurgy that would someday produce stainless steels.

Finally, in 1803, spectacular, well witnessed meteoritic falls in France and Norway provided many meteoritic samples for study by scientists, including the eminent French physicist Jean Baptiste Biot (1774-1862). Biot's work at last convinced scientists worldwide that masses of iron and stone do indeed arrive from interplanetary space and fall from the skies—just as the indigenous people of the Chaco had said from the beginning.

British Columbia Has Enjoyed a 140-Year Rush

by Ellsworth E. Dickson

The 1860s Cariboo Gold Rush in east-central British Columbia was not only a saga of epic proportions it was a pivotal turning point in how western North America defined its boundaries. This particular quest for gold actually took place in several rushes the initial placer discovery in rivers and streams, followed by the mining of ancient, buried placer deposits, then a lode gold rush in the 1930s, and finally the spring 2000 discovery of a previously unrecognized type of gold mineralization, which precipitated a new frenzy in claim staking.

Interestingly, the roots of the Cariboo Gold Rush began in California's Mother Lode country some 1,500 miles to the south. As California's placer deposits dwindled, prospectors headed north to the Fraser River, a major river that flows into the ocean near Vancouver, British Columbia. When word reached San Francisco that gold had been discovered on the Fraser River, the rush was on. Thousands of hopefuls, mostly Americans, descended on Victoria on the southern tip of Vancouver Island, about 70 miles south of the river's mouth.

In 1858, southern Vancouver Island and what are now parts of British Columbia, Washington and Oregon were controlled by the Hudson's Bay Co. of England, which managed a vast fur-trading empire. In the spring of that year, to the surprise of the 300

The author stands beside the richest creek in the Cariboo—the fabulous Williams Creek—where it is estimated that up to $40 million in placer gold was recovered. (Photo by Marian Rusychuk.)

or so white residents of what was then called Fort Victoria, four ships disembarked 1,700 prospectors seeking Fraser River gold. Most did not have a clue as to the incredible hardships they were about to face. Thousands more were to follow.

In the mad rush to reach the mouth of the Fraser, numerous miners drowned while crossing Georgia Strait on flimsy rafts. Those who made it to the Fraser River soon exhausted the deposits of fine placer gold and so proceeded upstream. To their horror, the miners discovered that about 80 miles inland, the Fraser turned north and cut through steep, forbidding canyons, including the notorious Hell's Gate. The river was impassible and horses had a terrible time packing supplies through the rugged mountains to bypass the killer rapids. But that didn't stop the miners. The gold nuggets kept getting bigger as the prospectors struggled upstream into what is called the Cariboo region.

The first gold discovery in the Cariboo occurred in 1860 when a local Indian named Long Baptiste led a party headed by Doc Keithley and George Weaver to a creek that still bears the name Keithley Creek. The gold discovery in Keithley Creek pointed the way to other gold-bearing creeks such as Antler Creek, which became a major gold producer. The small party attempted to keep their discoveries secret, but somehow word leaked out, and by January 1861 there were more than 400 miners living in snow holes.

One prospector, William "Dutch Bill" Deitz, finally made it into the heart of the Cariboo country, about 60 miles east of the present city of Quesnel, where he discovered the fabulously rich Williams Creek, which was named after him. This was no run-of-the-mill gold creek. In 10 short years, Williams Creek gave up gold worth an estimated $40 million at $20.65 per ounce. That represents some 2 million ounces of gold from one creek—worth about $500,000 at today's gold price.

continued on next page

Joy Stepan pans for gold on her placer lease on Lowhee Creek, a former major gold producer, where she guides tourists to pan for their own gold.

However, there were two serious problems. The most immediate one was the lack of food; miners were starving because access was so difficult hardly any supplies were getting through. Men were reduced to cooking and eating their boot leather! Secondly, with news of the gold riches spreading like wildfire, both Britain and the United States wanted to make the region part of their national land holdings. Back in Fort Victoria, Governor James Douglas dispatched 165 soldiers, miners, surveyors, architects and blacksmiths to build roads and survey towns that not only facilitated the gold rush, but also helped establish British control of what is now the province of British Columbia.

Meanwhile, in the Williams Creek area, crude towns of miners' cabins were sprouting up. Oddly enough, the Williams Creek gold discovery was a disappointment at first, with only small amounts of gold being found in the surface stream gravels. Then a miner named Abbott dug through a layer of blue clay that others had presumed was bedrock. In two days, Abbott recovered 50 ounces of gold, but that was nothing. The claim went on to produce 40 *pounds* of gold per day, with nearby claims doing even better. Still, this was only the beginning.

In the summer of 1862, a British sailor named Billy Barker jumped ship to seek his fortune, made his way to the Cariboo, and staked a claim on Williams Creek. Legend has it that he had a dream in which the number 52 appeared. Thinking this was significant, Billy Barker burrowed down through 52 feet of overburden and hit pay dirt worth $1,000 per longitudinal foot. In total, some $600,000 in gold was mined from his claim.

Other Williams Creek claims proved even more rewarding. The Caledonia claim saw $750,000 in recovered gold; the Steele produced $600,000. The Diller claim produced an incredible 102 pounds of gold in one day. Bill Diller bragged that he would mine his weight in gold—240 pounds—and he did, plus that of his 120-pound dog. Other claims were not so rich. The Six-Toed-Pete claim produced a measly $50,000 in gold.

In total, the Cariboo produced an amazing 93 tons of placer gold. More towns sprang up as thousands poured into the Cariboo: Stanley, Van Winkle, Cameronton, Richfield, and Barkerville, named after Billy Barker. By the mid 1860s, Barkerville had a population of 6,000. The nearby towns added another 4,000 souls, making the Cariboo Gold Camp the largest community west of Chicago and North of San Francisco.

Only Barkerville survives today. Barkerville never achieved status as a ghost town. Even though the British Columbian government declared the town a historic park site in 1958, residents continued to live in Barkerville until 1972, when Fred Thompson, the last permanent resident died. Many Chinese immigrants also tried their hand at placer mining and were noted for their detailed and methodical mining methods.

Placer mining continues to this day on Williams Creek, which runs alongside Barkerville, as well as other Cariboo creeks. Professional placer operations are presently underway on Frank Creek, the Quesnel River, Lightning Creek, Tregillius Creek, Williams Creek, Conklin Gulch, Hixon Creek, the Keithley Creek area, and Summit Creek. Frank Nestel owns a placer lease on Summit Creek, where he says he recovers several hundred ounces of gold per year. Although 70 years old, he has the strength and energy of a man half his age. A typical frontiersman, Frank, who is a fountain of local geological knowledge, says he has never read a geology textbook. He says that if the authors of geology textbooks really knew where the gold was they would be up here mining, not back in the city writing books!

Other professional placer miners are of the same mind. Brothers Tim and Jack Klemen have just finished constructing a washing plant on a truck trailer that is capable of treating 40 to 50 cubic yards of gravel per hour. The brothers mine their own claims and work for royalties on claims owned by others. When asked why so many placer claims are locked up but not being mined, Tim explained that many claim owners can't afford the expensive machinery and reclamation bonds; however, they hold their ground in hopes that someone will buy them out for huge amounts of cash.

Another professional placer miner, Pete Wright, works Conklin Gulch, a small tributary of Williams Creek. He sells his nuggets to a goldsmith, William Rummel, who operates an interesting old-time store, Mason & Daly General Merchants, in the beautifully restored town of Barkerville. Rummel, who uses an ancient goldsmithing technique he learned from century-old textbooks and a great deal of trial and error, creates unique and stunning jewelry from the nuggets, which run about 22 karats. Readers interested in visiting Barkerville can find more information on the Web sites www.barkerville.com and www.heritage.gov.bc.ca. Lodging is available at the St. George Hotel in downtown Barkerville (www.stgeorge.travel.bc.ca) or just down the road in Wells, where motels and RV sites are available.

The best part of this story is that rockhounds can participate in the Cariboo Gold Rush in various ways. One can follow the Gold Rush Trail by driving east and then north from Vancouver, up the rugged Fraser Canyon, and out into the more open country of the Cariboo. For diehard rockhounds, there are many stops along the way where a wide variety of minerals and gemstones can be found. There are numerous camping and RV sites on the road north (provincial Highway 97).

The best book on mineral sites is *Gold, Gemstones & Mineral Sites of British Columbia*, Vol. 2, by Rick Hudson (Orca Book Publishers, P.O. Box 468, Custer, WA 98240-0468, or P.O. Box 5626, Station B, Victoria, B.C., Canada V8R 6S4). This book is crammed with detailed maps depicting specific mineral sites and a great deal of information on places open to rockhounds. The book is available in just about every major bookstore in the Vancouver area, as well as at the Geological Survey of Canada store (605 Robson St.) in downtown Vancouver. Other books of interest in-

Cariboo Gold *from page 82*

clude *Gold Trails*, by Glenn Leaver (Sandhill Book Marketing, 1270 Ellis St., Kelowna, B.C., Canada V1Y 1Z4), and *Gold Panning*, by Jim Lewis and Charles Hart (Heritage House Publishing, Unit #108, 17665 66A Ave., Surrey, B.C., Canada V3S 2A7).

Under British Columbia's mineral tenure law, hand panning without machinery is allowed for recreational purposes on any creek in the province, except on a claim already staked or privately owned, in which case permission must be obtained. While visiting the Cariboo region, both placer and hard-rock claim maps covering your area of interest may be purchased for $2 from the Gold Commissioner's office at 102-350 Barlow Ave. in Quesnel. Canadian residents over 18 years of age can stake their own placer and mineral claims by writing an open-book examination to obtain a Free Miner Certificate. The yearly fee is $25.

A number of towns in the Cariboo, such as Horsefly and Likely, have historic mining museums and operators who provide gold panning expeditions for a reasonable cost. In Barkerville itself, the Eldorado Gold Panning and Souvenir Shop offers panning in large troughs for those unable to handle the rigors of digging in creek beds. Those of a more adventurous nature can hire llamas as pack animals for the trek to the Cariboo gold trials from B.C. Llama Treks (www.bcllamatreks.com).

Near the town of Wells, about a 10-minute drive from Barkerville, Joy Stepan operates Gold Safari Tours (www.goldsafaritours.com), where families can pan for gold in Lowhee Creek, formerly a major gold producer. During my interview on her placer lease, Joy chose some Lowhee Creek gravel at random, panned it, and obtained more than 30 flakes of gold in her first pan. She says many pans are similar, some with larger nuggets. There is no salting for tourists here; her customers actually make money in short order. Joy also offers fascinating and informative tours in the heart of the Cariboo and operates a small RV campsite.

The Lode Gold Rush

The frontier town of Wells is not only famous for placer gold, it was the scene of the next Cariboo gold rush. As placer gold production gradually decreased, the old-timers figured the coarse nuggets had to have come from a nearby source. By 1877, a number of gold-bearing quartz veins had been discovered on several mountains in the Wells-Barkerville area. However, even high-grade ore saw disappointing gold recoveries, as the cyanide recovery process had not yet been invented.

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Cariboo Gold *from page 83*

It wasn't until Englishman Fred Marshall Wells arrived in the early 1920s that serious lode mining became profitable. Considering the fabulous lode gold production that was about to take place, in hindsight it seems rather odd that earlier unfavorable geological reports prompted authorities to make it illegal to promote his mineral properties in Canada. Instead, a promoter from Seattle named Solibakke sold shares in the new company in the United States, England and Europe. In 1927, the group drove an adit into Cow Mountain, where rich gold-bearing quartz veins were encountered. This became part of the Cariboo Gold Quartz Mine, which began production in 1933.

The financing enabled the fledging company to build a mill, and the mine was a tremendous success. Within a year, the mine had produced more than 250,000 ounces of gold. By 1938, it was treating 275 tons of ore per day. Residents named the town that sprang up nearby after Wells. In the early 1930s, when most of Canada and the United States were in the depths of the Great Depression, Wells was a boomtown with work for everyone. The Cariboo Gold Quartz Mine had produced more than $25 million in gold at $32 per ounce when it finally closed in 1967. Total production was 626,755 ounces.

Meanwhile, the nearby Island Mountain Mine was brought into production in 1934 by U.S. mining company Newmont and produced continuously for 20 years. In the 1970s, the Mosquito Creek Mine and the connecting Aurum Mine operated from 1981 to 1987. Total production from these four mines was a hefty 38.3 tons of gold from over 3 million tons of ore grading 0.41 ounces per ton, which would be considered high grade today. Production from the underground lode mines was derived from two types of gold mineralization: gold-bearing quartz veins and pyrite pods or lenses, called replacement deposits. When the mills finally stopped operating, the population of Wells dropped from several thousand to only 250, where it stands today. But Cariboo's gold days weren't over yet.

Brothers Tim and Jack Kleman stand proudly beside their trailer-mounted gold washing plant, most of which they custom built. (Photo by the author)

A New Kind of Gold Discovery

About six years ago, Frank Callaghan had an idea. Tired of seeking the noble metal in South America with all the high costs, extensive travel, and occasional unethical business practices, he remembered the old prospector's adage that the best place to find a gold mine was near an old one.

Callaghan put together a small exploration company called International Wayside Gold Mines Ltd. and assembled a large land package, about 25 miles long and six miles wide, covering the gold trend in the Wells-Barkerville region. The claims encompassed the Cariboo Gold Quartz Mine and the other area mines. For several years, Callaghan spent every cent he could find on diamond drilling in hopes of locating more ore-grade gold mineralization. On more than one occasion he ran out of money and had to pay his drillers with his credit cards.

Then in fall 1999, while drilling into the formerly producing BC Vein at the headwaters of Stout's Gulch (which flows into Williams Creek on Barkerville Mountain, adjacent to the old Cariboo Gold Quartz Mine), the diamond bit cut into a dolomitic rock in the footwall of the vein. At first it meant nothing. However, when visiting geologist Bob Middleton viewed the drill core, he commented that he had seen a similar rock type in the Timmins Gold Camp in northern Ontario that was situated right beside high-grade gold-bearing rock. When Ned Reid, a company geologist, drilled a bit further in the spring of 2000, he encountered a distinctive pinky-tan gold-bearing rock that confirmed a type of gold discovery that was previously unrecognized.

Named the Bonanza Ledge, diamond-drill hole BC2K-30 returned a very impressive 0.804 ounces of gold per ton over 32.1 feet. Hole 31 gave more than 80 feet, grading 0.290 ounces of gold per ton. Company geologists also noted that the same geological environment, called the Cariboo Gold Trend, continued for miles in a northwest-southeast direction. Consequently, other resource companies perked up their ears, and a claim staking rush ensued. More than a dozen companies, both junior and senior, staked thousands of acres hoping to cash in on Wayside's success.

As exciting as the discovery was, the work had just begun. Due to the complex folding and faulting of the metamorphosed sedimentary rocks such as phyllites and schists, not every drill hole was a winner and it takes more than just a few good holes to make a mine. However, Godfrey Walton, vice president of exploration, and Dr. Richard Hall, consulting geologist, noted that in spite of the complex geology, a set pattern of gold mineralization was beginning to emerge. This pattern of Bonanza Ledge-style mineralization is expected to be predictable, making it possible to pinpoint diamond drill holes with a greater chance of success.

At the present time, two diamond drills are each recovering about 100 feet of drill core per day, homing in on the elusive pinky-tan rock laced with small pyrite crystals and tiny flecks of gold. Detailed geological reports, maps, underground cross-sections, and mineral photos of the Cariboo Gold Project can be found at www.wayside-gold.com. Meanwhile, the residents of Wells wait with bated breath to see if a mine can be built that would provide much-needed jobs.

Whether it was James Marshall's discovery on the American River in California in 1847, Billy Barker's strange dream of the number 52, or Frank Callaghan's lucky diamond drill, it is remarkable how many mineral discoveries have been flukes or accidents. One just never knows what riches could lie underfoot. So what are you waiting for? Grab your pick and get going. Just remember, if you make it big, try to hang on to your winnings. Billy Barker died poor in 1894 after making loans that were never repaid and saying "Drinks are on me" once too often in the local saloon.